

8503d/28

T H E TUTOR'S ASSISTANT; B E I N G A COMPENDIUM of ARITHMETIC, A N D A COMPLETE QUESTION-BOOK.

CONTAINING

- | | |
|--|---|
| <p>I. <i>Arithmetic</i> in Whole Numbers; being a brief Explanation of all its Rules, in a new and more concise Method than any hitherto published; with an <i>Application</i> to each Rule, consisting of a large Variety of Questions in real Business, with their Answers annexed.</p> <p>II. <i>Vulgar Fractions</i>, which are treated with a great deal of Plainness and Perspicuity.</p> <p>III. <i>Decimals</i>, with the <i>Extraction</i> of the <i>Square</i>, <i>Cube</i>, and <i>Biquadrate</i> Roots, after a very plain and</p> | <p>familiar Manner; in which are set down <i>Rules</i> for the easy Calculation of <i>Interest</i>, <i>Annuities</i>, and <i>Pensions</i> in <i>Arrears</i>, the <i>present Worth</i> of <i>Annuities</i>, &c. either by Simple or Compound Interest.</p> <p>IV. <i>Duodecimals</i> or <i>Multiplication</i> of Feet and Inches, with Examples applied to measuring and working by Multiplication, Practice, and Decimals.</p> <p>V. A <i>Collection</i> of <i>Questions</i> set down promiscuously, for the greater Trial of the foregoing <i>Rules</i>.</p> |
|--|---|

TO WHICH ARE ADDED,

A new and very short Method of extracting the CUBE ROOT, and a GENERAL TABLE for the ready calculating the INTEREST of any Sum of Money, at any Rate per Cent. likewise Rents, Salaries, &c.

The Whole being adapted either as a QUESTION-BOOK for the Use of Schools, or, as a REMEMBRANCER and INSTRUCTOR to such as have some Knowledge therein.

This Work having been perused by several Eminent MATHEMATICIANS and ACCOMPTANTS, is recommended as the best COMPENDIUM hitherto published, for the Use of SCHOOLS, or for PRIVATE PERSONS.

THE TWENTY-FIRST EDITION.

By FRANCIS WALKINGAME,
WRITING-MASTER and ACCOMPTANT.

PRINTED for the AUTHOR;

And sold by J. SCATCHERD, and I. WHITAKER, Successors
to E. JOHNSON, Ave-Mary-Lane. 1785.



P R E F A C E.

THE Public, no doubt, will be surprized to find there is another attempt made to publish a Book of ARITHMETIC, when there are such numbers already extant on the same Subject, and several of them that have so lately made their appearance in the World; but, I flatter myself, that the following reasons which induced me to compile it, the Method, and the Conciseness of the Rules, which are laid down in so plain and familiar a manner, will have some weight towards its having a favourable reception.

Having some time ago drawn up a Set of Rules, and proper Questions, with their Answers annexed, for the use of my own School, and divided them into several Books, as well for more ease to myself, as the readier Improvement of my Scholars, I found them, by experience, of infinite use; for when a Master takes upon him that laborious (though unnecessary) method of writing out the Rules and Questions in the children's books, he must either be toiling and

flaving himself, after the fatigue of the School is over, to get ready the Books for the next day, or else must lose that time which would be much better spent in instructing and opening the minds of his Pupils. There was, however, still an inconvenience which hindered them from giving me the Satisfaction I at first expected; *i. e.* where there are several boys in a class, some one or other must wait till the boy who first has the book, finishes the writing out those rules or questions he wants; which detains the others from making that progress they otherwise might, had they a proper Book of Rules and Examples for each; to remedy which, I was prompted to compile one, in order to have it printed, that might not only be of use to my own School, but to such others as would have their Scholars make a quick progress. It will also be of great use to such Gentlemen as have acquired some knowledge of numbers at School, to make them the more perfect; likewise to such as have completed themselves therein, it will prove, after an impartial perusal, on account of its great variety and brevity, a most agreeable and entertaining Exercise Book. I shall not presume to say any thing more in favour of this Work, but beg leave to refer the unprejudiced reader to the remark of a certain Author*, concerning compositions of this nature. His words are as follow:

“ And now, after all, it is possible that some
“ who like best to tread the old beaten path,
and

* *Dilworth.*

“ and to sweat at their business, when they may
“ do it with pleasure, may start an objection
“ against the use of this well-intended ASSIST-
“ ANT, because the course of ARITHMETIC is
“ always the same; and therefore say, *That*
“ *some Boys, lazily inclined, when they see another*
“ *at work upon the same Question, will be apt to*
“ *make his operation pass for their own.* But these
“ little forgeries are soon detected, by the dili-
“ gence of the TUTOR: Therefore, as different
“ questions to different boys do not in the least
“ promote their improvement, so neither do the
“ questions hinder it. Neither is it in the power
“ of any Master (in the course of his business) how
“ full of spirits soever he be, to frame new ques-
“ tions at pleasure, in any Rule; but the same
“ question will frequently occur in the same
“ Rule, notwithstanding his greatest care and
“ skill to the contrary.

“ It may also be further objected, *That to*
“ *teach by a printed Book is an argument of Igno-*
“ *rance and Incapacity;* which is no less trifling
“ than the former. He, indeed (if any such
“ there be) who is afraid his Scholars will im-
“ prove too fast, will, undoubtedly, decry this
“ method: but that master's ignorance can never
“ be brought in question, who can begin and end
“ it readily; and, most certainly, that scholar's
“ non-improvement can be as little questioned,
“ who makes a much greater progress by this
“ than by the common method.”

To enter into a long detail of every Rule, would tire the reader, and swell the Preface to an unusual length; I shall, therefore, only give a general idea of the method of proceeding, and leave the rest to speak for itself; which, I hope, the kind reader will find to answer the title, and the recommendation given it. As to the Rules, they follow in the same manner as the table of contents specifies, and in much the same order as they are generally taught in Schools. I have gone through the four fundamental Rules in Integers first, before those of the several denominations: in order that they being well understood, the latter will be performed with much more ease and dispatch, according to the rules shewn, than by the customary method of dotting. In Multiplication I have shewn both the beauty and use of that excellent Rule, in resolving most Questions that occur in merchandizing; and have prefixed before Reduction, several bills of Parcels, which are applicable to real business. In working Interest by Decimals, I have added Tables to the Rules, for the readier calculating Annuities, &c. and have not only shewn the use, but the method of making them. I have also added to this *Edition* a NEW RULE for extracting the *Cube Root*, being a much shorter way than any that is already published; as likewise an Interest-Table calculated for the easier finding the Interest of any Sum of money at any Rate *per Cent.* by Multiplication and Addition only; it is also useful in calculating Rents, Incomes, and Servants Wages, for any number of Months, Weeks, or Days; and I may venture to say, I have gone through the whole

whole with so much plainness and perspicuity, that there is none better extant.

I have nothing further to add, but a return of my sincere thanks to all those Gentlemen, Schoolmasters, and others, whose kind approbation and encouragement hath now established the use of this book in almost every School of eminence throughout the Kingdom: but I think my gratitude more especially due to those who have favoured me with their remarks; though, I must still beg of every candid and judicious Reader, that if he should, by chance, find a transposition of a Letter, or a false Figure, to excuse it; for, notwithstanding there has been great care taken in correcting, yet errors of the Press will inevitably creep in; and some may also have slipped my observation: in either of which cases, the Admonition of a good-natured Reader will be very acceptable to his

much obliged,

and most obedient

humble Servant,

KENSINGTON,
1785.

F. WALKINGAME.

Just Published, by SCATCHERD *and* WHITAKER,
Ave-Mary-Lane,

THE CAMBRIDGE PHÆDRUS:

B EING a neat and correct Edition of PHÆDRI AUGUSTI LIBERTI FABULARUM ÆSOPIARUM LIBRI QUINQUE: or, a correct Latin Edition of the Fables of Phædrus; with a new literal English Translation; and a large Parsing Index. By a Gentleman of the University of Cambridge. Price 1s. 6d. bound.

* * * This Work is divided into Three Parts: The first contains the original Text, printed after the best Editions; and those of Bishop Hare and Dr. Bentley are particularly regarded. In the Second is the Translation, done in the manner of the Construction to Lilly's Grammar; wherein the Ellipses in the Text are supplied, for the Information and Ease of the Learner. The Parsing Index makes the Third Part; in which every Word used in this Author may be found, without the Assistance or Use of a Dictionary; and each Word (where necessary) is so accented, that young Beginners may know the true Pronunciation. The whole intended to be an easy Guide to Youth of the meanest Capacities, to learn their Lessons with Pleasure and Exactness; and also a means of rendering the Fatigue and Trouble of the Teacher more light and agreeable.

N. B. The following Character of it was given by the Author of the Monthly Review:

“ This Edition of Phædrus appears to be better adapted
“ than any of those hitherto published, to answer the End of
“ instructing young Beginners in the Knowledge of the Latin
“ Tongue.”

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Explanation of the Characters made use of in this COMPENDIUM.

$=$ *Equal.* The Sign of Equality ; as, 4 qrs. $=$ 1 cwt. signifies, that 4 qrs. are equal to 1 cwt.

$-$ *Minus or Less.* The Sign of Subtraction ; as, $8 - 2 = 6$, that is, 8 lessened by 2 is equal to 6.

$+$ *Plus or more.* The sign of Addition ; as $4 + 4 = 8$, that is, 4 added to 4 more is equal to 8.

\times *Multiplied by.* The Sign of Multiplication ; as, $4 \times 6 = 24$ that is, 4 multiplied by 6 is equal to 24.

\div *Divided by.* The Sign of Division ; as, $8 \div 2 = 4$, that is, 8 divided by 2 is equal to 4.

$\frac{2357}{63}$. Numbers placed like a Fraction do likewise denote Division ; the upper Number being the Dividend and the lower Divisor.

$::$ *So is* The sign of proportion ; as $2 : 4 :: 8 : 16$, that is, as 2 is to 4, so is 8 to 16.

$7 - 2 + 5 = 10$. Shews that the Difference between 2 and 7 added to 5 is equal to 10.

$9 - 2 + 5 = 2$ Signifies that the Sum of 2 and 5 taken from 9, is equal to 2.

$\sqrt{\quad}$ Prefixed to any number, signifies the Square Root of that number is required.

$\sqrt[3]{\quad}$ Signifies the Cube, or Third Power.

$\sqrt[4]{\quad}$ Denotes the Biquadrate, or the fourth Power, &c.

i. e. *id est*, that is.

THE
TUTOR'S ASSISTANT.
BEING
A COMPENDIUM OF ARITHMETIC.

PART I.

Arithmetic in Whole Numbers.

THE INTRODUCTION.

ARITHMETIC is the Art or Science of computing by Numbers, and consists both in Theory and Practice.

The Theory considers the Nature and Quality of Numbers, and demonstrates the Reason of practical Operations.

The Practice is that which shews the Method of working by Numbers, so as to be the most useful and expeditious for business, and has five principal or fundamental Rules for the Operations: *viz.*

NOTATION or NUMERATION, ADDITION, SUBTRACTION, MULTIPLICATION, and DIVISION.

NUMERATION

TEACHETH the different Value of Figures by their different Places, and to read and write any Sum or Number.

The T A B L E.

C Millions. X Millions. Millions.			C Thousands. X Thousands. Thousands.			Hundreds. Tens. Units.		
9	8	7	6	5	4	3	2	1
9	0	0	0	0	0	0	0	0
	8	0	0	0	0	0	0	0
		7	0	0	0	0	0	0
			6	0	0	0	0	0
				5	0	0	0	0
					4	0	0	0
						3	0	0
							2	0
								1

RULE. There are three Periods; the First on the Right Hand, Units; the Second, Thousands; and the Third, Millions; each consisting of Three Figures, or Places. Reckon the first Figure of each from the Left Hand as so many Hundreds, the next as Tens, and the Third as so many single Ones of what is written over them: As the first Period on the Left Hand is read thus, Nine Hundred Eighty-seven Millions; and so on for any of the rest.

The APPLICATION.

Write down in proper Figures the following Numbers:

Twenty-three.

Two Hundred and Fifty-four.

Three Thousand, Two Hundred and Four.

Twenty-five Thousand, Eight Hundred Fifty-six.

One Hundred Thirty-two Thousand, Two Hundred Forty-five.

Four Millions, Nine Hundred Forty-one Thousand, Four Hundred.

Twenty-seven Millions, One Hundred Fifty-seven Thousand, Eight Hundred, Thirty-two.

Seven Hundred Twenty-two Millions, Two Hundred Thirty-one Thousand, Five Hundred and Four.

Six Hundred Two Millions, Two Hundred Ten Thousand, Five Hundred.

Write

ASSISTANT.

Addition of Integers. 3

Write down in Words at Length the following Numbers.

35	2017	519007	5207054	65700047
59	5201	750058	2071909	900061057
172	20760	5900030	70054008	201900790

Notation by ROMAN Letters.

I One.	XXX Thirty.
II Two.	XL Forty.
III Three.	L Fifty.
IV Four.	LX Sixty.
V Five.	LXX Seventy.
VI Six.	LXXX Eighty.
VII Seven.	XC Ninety.
VIII Eight.	C Hundred.
IX Nine.	CC Two Hundred.
X Ten.	CCC Three Hundred.
XI Eleven.	CCCC Four Hundred.
XII Twelve.	D Five Hundred.
XIII Thirteen.	DC Six Hundred.
XIV Fourteen.	DCC Seven Hundred.
XV Fifteen.	DCCC Eight Hundred.
XVI Sixteen.	DCCCC Nine Hundred.
XVII Seventeen.	M One Thousand.
XVIII Eighteen.	MDCCLXXXV One Thou-
XIX Nineteen.	sand, Seven Hundred and
XX Twenty.	Eighty Five.

I N T E G E R S.

A D D I T I O N

TEACHETH to add two or more Sums together, to make one whole or total Sum.

RULE. There must be due Regard had in placing the Figures one under the other, *i. e.* Units under Units. Tens under Tens, &c. then beginning with the first Row of Units, add them up to the Top; when done, set down the Units and carry the Tens to the next, and so on; continuing to the last Row, at which set down the total Amount.

PROOF. Begin at the Top of the Sum, and reckon the Figures downwards, the same as you added them up, and, if the same as the first, the Sum is supposed to be right.

ADDITION and SUBTRACTION TABLE.

1	2	3	4	5	6	7	8	9
2	4	5	6	7	8	9	10	11
3	5	6	7	8	9	10	11	12
4	6	7	8	9	10	11	12	13
5	7	8	9	10	11	12	13	14
6	8	9	10	11	12	13	14	15
7	9	10	11	12	13	14	15	16
8	10	11	12	13	14	15	16	17
9	11	12	13	14	15	16	17	18

£.	Cwt.	Qrs.	Months.	£.	Years.
2	27	275	1234	7524	27104
5	35	110	7098	3750	32547
7	47	473	3314	9147	10758
9	35	354	6732	3214	62590
2	41	271	2546	4725	75408
5	36	352	3709	2147	27973
4	59	471	4152	3254	85421
3	37	310	3705	2716	12706
7	14	437	1076	1047	10471
44	331				

SUBTRACTION

TEACHETH to take a less Number from a greater, and shews the Remainder, or Difference.

RULE. This being the Reverse of Addition, you must borrow here (if it requires) what you stopped at there, always remembering to pay it to the next.

PROOF. Add the Remainder and less Line together, and if the same as the greater, it is right.

	£.	Hund.	Hours.	Weeks.	Hogs.	Minutes.
From	271	4754	42087	452705	271508	3750214
Take	154	2725	34096	327616	152471	2150873
Rem.	117					
Proof.	271					

MULTIPLICATION

MULTIPLICATION

TEACHETH how to increafe the greater of two Numbers given, as often as there are Units in the lefs ; and compendiously performs the Office of many Additions.

To this Rule belong three principal Members : viz.

- 1, The Multiplicand, or Number to be multiplied :
- 2, The Multiplier, or Number by which you multiply :
- 3, The Product, or Number produced by multiplying.

RULE. Begin with that Figure that stands in the Unit's place of the Multiplier, and with it multiply the first Figure in the Unit's place of the Multiplicand. Set down the Units, and carry the Tens in Mind, till you have multiplied the next Figure in the Multiplicand by the same Figure in the Multiplier ; to the Product of which add the Tens you kept in Mind, setting down the Units, and proceed as before, till the whole Line is multiplied.

PROOF. The usual Way of proving Multiplication is, by casting out the Nines from the Multiplicand and Multiplier : the Remainders put on each Side of a Cross ; multiply the Figures on each Side together, cast the Nines from the Product, and put the Overplus at Top ; then cast out the Nines from the Product of the Multiplication, and its Remainder place at the Bottom ; if it agrees with the Top, the Work is supposed right. But the surest Way is, to divide the Product by the Multiplicand, and the Quotient will be the same as the Multiplier.

MULTIPLICATION and DIVISION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

6. Multiplication of Integers.

The Tutor's

Multiplicand	25104736	52471021	7925437521
Multiplier	2	3	4

Product 50209472

27104107	231047	7092516	3725104
5	6	7	8

4215406	2701047	31040171	35210472
9	10	11	12

When the Multiplier is more than 12, and less than 20, multiply by the Unit Figure in the Multiplier, adding to the Product the back Figure to that you multiplied.

5710592	5107252	7653210	92057165
13	14	15	16

6251721	9215324	2571341	3592104
17	18	19	19

When the Multiplier consists of several Figures, there must be as many Products as there are Figures in the Multiplier, observing to put the first Figure of every Product under that Figure you multiply by. Add the several Products together, and their sum will be the total Product.

0	271041	32104	2710432	27501976
6 + 0	27	25	375	271
0				
	1897287	802600	1016412000	7453035496
	542082			
	7318107			

When Cyphers are placed between the significant Figures in the Multiplier, they may be omitted; but great Care must be taken that the next Figure must be put one Place more to the left hand, *i. e.* under the Figure you multiply by.

571204

ASSISTANT.

Division. 7

571204 27009	7104325 57020	5271094 590030
<hr/> 15427648836	<hr/> 405088611500	<hr/> 3110103592820

When there are Cyphers at the end of the Multiplicand or Multiplier, they may be omitted, by only multiplying by the rest of the Figures, and setting down on the right Hand of the total Product as many Cyphers as were omitted.

27100 52600	379500 274000	265000 7200	574000 630
<hr/> 1425460000	<hr/> 103983000000	<hr/> 1908000000	<hr/> 361620000

When the Multiplier is a composite Number, *i. e.* if any two Figures, being multiplied together, will make that Number, then multiply by one of those Figures, and that Product by the other will give the Answer.

771039 by 35	921563 by 32	715241 by 56
<hr/> 26986365	<hr/> 29490016	<hr/> 40053496

D I V I S I O N

TEACHETH to find how often one Number is contained in another; or to divide any Number into what Parts you please.

In this Rule there are three Numbers real, and a fourth accidental: *viz.*

- 1, The Dividend, or Number to be divided:
- 2, The Divisor, or Number by which you divide:
- 3, The Quotient, or Number that shews how often the Divisor is contained in the Dividend:
- 4th, or accidental Number, is what remains when the Work is finished, and is of the same Name as the Dividend.

RULE. When the Divisor is less than 12, find how often it is contained in the first Figure of the Dividend: set it down under the Figure you divided, and carry the Overplus (if any) to the next in the Dividend, as so many Tens; then find how often the Divisor is contained therein, set it down, and continue the same till you have gone through the

8 Division of Integers.

The TUTOR'S

the Line: But when the Divisor is more than 12, multiply it by the Quotient Figure; the Product subtract from the Dividend, and to the Remainder bring down the next Figure in the Dividend, and proceed as before, till the Figures are all brought down.

PROOF. Multiply the Divisor and Quotient together, adding the Remainder, (if any) and the Product will be the same as the Dividend.

	Dividend	Rem.			
Divisor	2)725107(1		3)7210472(		4)7210416(
Quotient	<u>362553</u> 2		<u> </u>		<u> </u>
Proof	<u>725107</u>		5)7203287(		6)5231037(
	<u>7)2532701(</u>		<u> </u>		<u> </u>
	<u>10)2750012(</u>		8)2547325(		9)25047306(
	<u> </u>		<u> </u>		<u> </u>
	<u> </u>		11)2710513(		12)27100732(
	<u> </u>		<u> </u>		<u> </u>

Divisor. Dividend. Quotient.

29)4172377(143875

29 29

127 1294875

116 287750

2 Rem.

.112

87 4172377 Proof

253

217

203

.147

145

Rem. 2

37)7210473(194877

473)2104721(4449

275)3720147(13527

3701)72109521(19483

3576)72104725(20163

2510)63210476(25183

25204)321047217(12737

31709)521047321(16482

2701234)7210472532(2669

210472)352107193214(1672940

3721071)21071921473(5662

When

ASSISTANT.

Tables of Money. 9

When there are Cyphers at the End of the Divisor, they may be cut off, and as many Places from off the Dividend, but must be annexed to the Remainder at last.

271|00)254732|21(939 5721|00)7253472|16(1267
373|000)752473|719(2017 215|000)6325104|997(29419

When the Divisor is a composite Number (*i. e.* if any two Figures being multiplied together, will make that Number) then, by dividing the Dividend by one of those Figures, and that Quotient by the other, it will give the Quotient required.—But as it sometimes happens, that there is a Remainder to each of the Quotients, and neither of them the true one, it may be found by this

RULE. Multiply the first Divisor into the last Remainder, to that Product add the first Remainder, which will give the true one.

Div. 3210473 by 27 7210473 by 35 6251043 by 42 5761034 by 54
118906. 11 Rem. 206013. 18 Rem. 148834. 15 Rem. 106685. 44 Rem.

M O N E Y.

Marked

Marked

$\frac{1}{4}$ Farthing. 4 Farthings make 1 Penny. - *d.*
 $\frac{1}{2}$ Halfpenny. 12 Pence - - - - 1 Shilling - *s.*
 $\frac{3}{4}$ Three Farthings. 20 Shillings - - 1 Pound. - *l.*
Farthings.

4 = 1 Penny.

48 = 12 = 1 Shilling.

960 = 240 = 1 Pound.

SHILLINGS.

PENCE TABLE.

<i>s.</i>		<i>l.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>
20	-	1	:	0	20	-	1	:	8
30	-	1	:	10	24	-	2	:	0
40	-	2	:	0	30	-	2	:	6
50	-	2	:	10	36	-	3	:	0
60	-	3	:	0	40	-	3	:	4
70	is	3	:	10	48	is	4	:	0
80	-	4	:	0	50	-	4	:	2
90	-	4	:	10	60	-	5	:	0
100	-	5	:	0	70	-	5	:	10
110	-	5	:	10	72	-	6	:	0
120	-	6	:	0	80	-	6	:	8
130	-	6	:	10	84	-	7	:	0

TROY

TROY WEIGHT. ✓

24 Grains	- - make	-	1 Pennyweight.	<div>Marked</div> <div> <div>{</div> <div>gr.</div> <div>dwt.</div> <div>oz.</div> <div>lb.</div> </div>
20 Pennyweights	- - -	-	1 Ounce	
12 Ounces	- - - -	-	1 Pound	

Grains.

24	=	1 Pennyweight.
480	=	20 = 1 Ounce.
5760	=	240 = 12 = 1 Pound.

By this Weight are weighed Gold, Silver, Jewels, Electuaries, and all Liquors.

N. B. The Standard for Gold Coin is 22 Carats of fine Gold, and 2 Carats of Copper, melted together. For Silver, is 11 oz. 2 dwts. of fine Silver, and 18 dwts. of Copper.

25 lb. is a Quarter of an cwt. 100 lb. 1 cwt.

20 cwt. 1 Ton of Gold or Silver.

AVOIRDUPOISE WEIGHT. ✓

16 Drams	- - make	-	1 Ounce.	<div>Marked</div> <div> <div>{</div> <div>dr.</div> <div>oz.</div> <div>lb.</div> <div>grs.</div> <div>cwt.</div> <div>Ton.</div> </div>
16 Ounces	- - -	-	1 Pound	
28 Pounds	- - -	-	1 Quarter	
4 Quarters, or 112 lb.	-	-	1 Hundred Weight	
20 Hundred Weight	- -	-	1 Ton	

Drams.

16	=	1 Ounce.
256	=	16 = 1 Pound.
7168	=	448 = 28 = 1 Quarter.
28672	=	1792 = 112 = 4 = 1 Hund.Weight.
575440	=	35840 = 2240 = 80 = 20 = 1 Ton.

There are several other Denominations in this Weight, that are used in some particular Goods: viz.

	lb.		7b.
A Firkin of Butter	- 56	A Stone of Iron Shot	} 14
Soap	- 94	or Horseman's wt.	
A Barrel of Anchovies	30	Butcher's Meat	8
Soap	- 256	A Gallon of Train Oil	7½
Raisins	- 112	A Truss of Straw	36
A Puncheon of Prunes	1120	New Hay	60
A Fother of Lead, 19 cwt.		Old Hay	56
2 grs.		36 Trusses a Load.	

Cheese

Cheese and Butter.

A Clove, or Half Stone, 8lb.

A Wey in Suffolk, }	lb.	A Wey in Essex, }	lb.
32 Cloves, or }	256	42 Cloves, or }	336

Wool.

	lb.	A Wey is 6 Tod and }	lb.
A Clove - - - - -	7	1 Stone, or }	182
A Stone - - - - -	14	A Sack is 2 Weys, or	364
A Tod - - - - -	28	A Last is 12 Sacks, or	4368

By this Weight is weighed any thing of a coarse or droffy Nature ; as all Grocery and Chandlery Wares : Bread, and all Metals but Silver and Gold.

Note, 1 Pound Avoirdupoise is equal to 14 oz. 11 dwts. 15 grs. $\frac{1}{2}$ Troy.

APOTHECARIES WEIGHT.

					Marked
20 Grains - make - - -	1	Scruple - - - -			3
3 Scruples - - - - -	1	Dram - - - - -			3
8 Drams - - - - -	1	Ounce - - - - -			3
12 Ounces - - - - -	1	Pound - - - - -			16

Grains.

20 = 1 Scruple.

60 = 3 = 1 Dram.

480 = 24 = 8 = 1 Ounce.

5760 = 288 = 96 = 12 = 1 Pound.

Note, The Apothecaries mix their Medicines by this Rule, but buy and sell their Commodities by Avoirdupoise Weight.

The Apothecaries Pound and Ounce, and the Pound and Ounce Troy, are the same, only differently divided and subdivided.

CLOTH MEASURE

					Marked
4 Nails - make - - -	1	Quarter of a Yard			{ n. qrs.
3 Quarters - - - - -	1	Flemish Ell - - -			FE.
4 Quarters - - - - -	1	Yard - - - - -			yd.
5 Quarters - - - - -	1	English Ell - - -			E. F.
6 Quarters - - - - -	1	French Ell - - -			Fr. E.
					Inches

Inches.

$2\frac{1}{4}$	=	1	Nail.
9	=	4	= 1 Quarter.
36	=	16	= 4 = 1 Yard.
27	=	12	= 3 = 1 Flemish Ell.
45	=	20	= 5 = 1 English Ell.

LONG MEASURE.

3 Barley Corns - make	1 Inch	-	-	Marked bar. in.
12 Inches	-	-	1 Foot	feet.
3 Feet	-	-	1 Yard	yd.
6 Feet	-	-	1 Fathom	fth.
$5\frac{1}{2}$ Yards	-	-	1 Rod, Pole or Perch.	rod. p.
40 Poles	-	-	1 Furlong	fur.
8 Furlongs	-	-	1 Mile	mile.
3 Miles	-	-	1 League	lea.
60 Miles	-	-	1 Degree	deg.

Barley Corns.

3	=	1	Inch.
36	=	12	= 1 Foot.
108	=	36	= 3 = 1 Yard.
549	=	198	= $16\frac{1}{2}$ = $5\frac{1}{2}$ = 1 Pole.
23760	=	7920	= 660 = 220 = 40 = 1 Furlong
190080	=	63360	= 5280 = 1760 = 320 = 8 = 1 Mile

N. B. A Degree is 69 Miles, 4 Furlongs, nearly, though commonly reckoned but 60 Miles.

This Measure is used to measure Distance of Places, or any thing else that hath Length only.

WINE MEASURE.

2 Pints - make	-	-	1 Quart	-	-	Marked pt. qts.
4 Quarts	-	-	1 Gallon	-	-	gal.
10 Gallons	-	-	1 Anchor of Brandy	-	-	anc.
18 Gallons	-	-	1 Runlet	-	-	run.
$31\frac{1}{2}$ Gallons	-	-	Half an Hoghead	-	-	$\frac{1}{2}$ bhd.
42 Gallons	-	-	1 Tierce	-	-	tierce.
63 Gallons	-	-	1 Hoghead	-	-	bhd.
2 Hogheads	-	-	1 Pipe or Butt	-	-	P. or Butt.
2 Pipes or 4 Hogheads	-	-	1 Tun	-	-	tun.

Inches.

Inches.

$28\frac{7}{8}$	=	1	Pint.
$57\frac{1}{4}$	=	2	= 1 Quart.
231	=	8	= 4 = 1 Gallon.
9072	=	336	= 168 = 42 = 1 Tierce.
14553	=	504	= 252 = 63 = $1\frac{1}{2}$ = 1 Hoghead.
19404	=	672	= 336 = 84 = 2 = $1\frac{1}{3}$ = 1 Puncheon.
29106	=	1008	= 504 = 126 = 3 = 2 = $1\frac{1}{2}$ = 1 Pipe.
58212	=	2016	= 1008 = 252 = 6 = 4 = 3 = 2 = 1 Tun.

All brandies, spirits, perry, cyder, mead, vinegar, honey, and oil, are measured by this measure; as also milk: not by law, but custom only.

ALE and BEER MEASURE.

2 Pints	-	make	- -	1 Quart	- -	$\left\{ \begin{array}{l} Pts. \\ Qts. \end{array} \right.$
4 Quarts	- - - -	1	Gallon	- -		Gal.
8 Gallons	- - - -	1	Firkin of Ale	- -		A. fir.
9 Gallons	- - - -	1	Firkin of Beer	- -		B. fir.
2 Firkins	- - - -	1	Kilderkin	- -		Kil.
4 Firkins, or 2 Kilderkins		1	Barrel	- -		Bar.
1 Barrel and $\frac{1}{2}$, or 54 Gall.		1	Hoghead of Beer			Hbd.
2 Barrels	- - - -	1	Puncheon	- -		Pun.
3 Barrels, or 2 Hogheads		1	Butt	- - -		Butt.

B E E R.

Cubic Inches.

$35\frac{1}{4}$	=	1	Pint.
$70\frac{1}{2}$	=	2	= 1 Quart.
282	=	8	= 4 = 1 Gallon.
2538	=	72	= 36 = 9 = 1 Firkin.
5076	=	144	= 72 = 18 = 2 = 1 Kilderkin.
10152	=	288	= 144 = 36 = 4 = 2 = 1 Barrel.
15228	=	432	= 216 = 54 = 6 = 3 = $1\frac{1}{2}$ = 1 Hoghead.
20304	=	576	= 288 = 72 = 8 = 4 = 2 = 1 Puncheon.
30456	=	864	= 432 = 108 = 12 = 6 = 3 = 2 = 1 Butt.

A L E.

Cubic Inches.

$35\frac{1}{4}$	=	1	Pint.
$70\frac{1}{2}$	=	2	= 1 Quart.
282	=	8	= 4 = 1 Gallon.
2256	=	64	= 32 = 8 = 1 Firkin.
4512	=	128	= 64 = 16 = 2 = 1 Kilderkin.
9024	=	256	= 128 = 32 = 4 = 2 = 1 Barrel.
13536	=	384	= 192 = 48 = 6 = 3 = $1\frac{1}{2}$ = 1 Hoghead.

In *London* they compute but 8 gallons to the firkin of ale, and 32 to the barrel; but in all other parts of *England*, for ale, strong beer, and small, 34 gallons to the barrel, and 8 gallons and $\frac{1}{2}$ to the firkin.

N. B. A barrel of salmon or eels is - - 42 gallons.
 A barrel of herrings - - - - 32 gallons.
 A keg of sturgeon - - - - 4 or 5 gallons.
 A firkin of soap - - - - 8 gallons.

D R Y M E A S U R E.

2 Pints	-	make	-	-	-	1 Quart	-	-	Marked } <i>pts.</i> } <i>qts.</i>
2 Quarts	-	-	-	-	-	1 Pottle	-	-	<i>pot.</i>
2 Pottles	-	-	-	-	-	1 Gallon	-	-	<i>gal.</i>
2 Gallons	-	-	-	-	-	1 Peck	-	-	<i>pk.</i>
4 Pecks	-	-	-	-	-	1 Bushel	-	-	<i>bu.</i>
2 Bushels	-	-	-	-	-	1 Strike	-	-	<i>strike.</i>
4 Bushels	-	-	-	-	-	1 Coom	-	-	<i>coom.</i>
2 Cooms, or 8 Bushels	-	-	-	-	-	1 Quarter	-	-	<i>qr.</i>
4 Quarters	-	-	-	-	-	1 Chaldron	-	-	<i>chal.</i>
5 Quarters	-	-	-	-	-	1 Wey	-	-	<i>wey.</i>
2 Weys	-	-	-	-	-	1 Last	-	-	<i>last.</i>

In *London* 36 bushels make a chaldron.

Solid Inches.

268 $\frac{1}{2}$	=	1 Gallon.
537	=	2 = 1 Peck.
2150 $\frac{1}{2}$	=	8 = 4 = 1 Bushel.
4300 $\frac{1}{2}$	=	16 = 8 = 2 = 1 Strike.
8601	=	32 = 16 = 4 = 2 = 1 Coom.
17203 $\frac{1}{2}$	=	64 = 32 = 8 = 4 = 2 = 1 Quarter.
86016	=	320 = 160 = 40 = 20 = 10 = 5 = 1 Wey.
172032	=	640 = 320 = 80 = 40 = 20 = 10 = 2 = 1 Last.

The bushel in *Water Measure* is 5 pecks.

A score of coals - is - - 21 chaldron.

A sack of coals - - - - 3 bushels.

A chaldron of coals - - - 12 sacks.

A load of corn - - - - 5 bushels.

A cart load ditto - - - 40 bushels.

This measure is applied to all dry goods.

The standard bushel is 18 inches and $\frac{1}{2}$ wide, and 8 inches deep.

T I M E.

TOR'S

of ale,
d, for
and 8

s.
s.
llons.

ked

ASSISTANT.

Tables of Measure. 15

T I M E.

60 Seconds	- - make	- - 1 Minute	-	Marked
60 Minutes	- - - - -	1 Hour	- -	"
24 Hours	- - - - -	1 Day	- -	m.
7 Days	- - - - -	1 Week	- -	hour.
4 Weeks	- - - - -	1 Month	- -	day.
13 Months, 1 day, 6 hours	-	1 Julian year	-	week.
				mo.
				yr.

Seconds.

60=	1 Minute.
3600=	60= 1 Hour.
86400=	1440= 24= 1 Day.
604800=	10080= 168= 7= 1 Week.
2419200=	40320= 672= 28= 4= 1 Month.
	d h w d h
31557600=525960=8766=365.6=52.1.6=1 Julian year.	d h m "
31556937=525948=8765=365.5.48.57=1 Solar year.	

To know the days in each month, observe,

*Thirty days hath September,
April, June, and November :
February hath twenty-eight alone,
All the rest have thirty and one ;
Except in Leap-Year, and then's the time,
February's days are twenty and nine.*

S Q U A R E M E A S U R E.

144 Inches	- - make	- - - - -	1 Foot.
9 Feet	- - - - -	- - - - -	1 Yard.
100 Feet	- - - - -	- - - - -	1 Square of flooring.
272½ Feet	- - - - -	- - - - -	1 Rod.
40 Rods	- - - - -	- - - - -	1 Rood.
4 Roods, or 160 rods, or 4840 yards	-	-	1 Acre of land.
640 Acres	- - - - -	- - - - -	1 Square mile.
30 Acres	- - - - -	- - - - -	1 Yard of land.
100 Acres	- - - - -	- - - - -	1 Hide of land.

C 2 Inches

Inches.

$$144 = 1 \text{ Foot.}$$

$$1296 = 9 = 1 \text{ Yard.}$$

$$39204 = 272\frac{1}{4} = 30\frac{1}{4} = 1 \text{ Pole.}$$

$$568160 = 10890 = 1210 = 40 = 1 \text{ Rood.}$$

$$6272640 = 43560 = 4840 = 160 = 4 = 1 \text{ Acre.}$$

By this measure are measured all things that have length and breadth: such as land, painting, plaistering, flooring, thatching, plumbing, glazing, &c.

S O L I D M E A S U R E.

$$1728 \text{ Inches} - \text{make} - 1 \text{ Solid foot.}$$

$$27 \text{ Feet} - - - - 1 \text{ Yard, or load of earth.}$$

$$40 \text{ Feet of round timber } \left. \vphantom{\begin{array}{l} 40 \\ 50 \end{array}} \right\} \text{ is } 1 \text{ ton or load.}$$

$$\text{Or, } 50 \text{ Feet of hewn timber } \left. \vphantom{\begin{array}{l} 40 \\ 50 \end{array}} \right\}$$

108 solid feet, *i. e.* 12 feet in length, 3 feet in breadth, and 3 deep, or, commonly, 14 feet long, 3 feet 1 inch broad, and 3 feet 1 inch deep, is a stack of wood.

128 solid feet, *i. e.* 8 feet long, 4 feet broad, and 4 feet deep, is a cord of wood.

By this measure are measured all things that have length, breadth, and depth.

ADDITION of MONEY, WEIGHTS, and MEASURES.

RULE. Add the first row or denomination together, as in integers; then divide the sum by as many of the same denomination as make one of the next greater, setting down the remainder under the row added, and carry the quotient to the next superior denomination, continuing the same to the last, which add as in simple Addition.

M O N E Y.

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
2	13	5 $\frac{1}{2}$	27	7	2	35	17	3	75	3	7
7	9	4 $\frac{1}{4}$	34	14	7 $\frac{1}{4}$	59	14	7 $\frac{1}{2}$	54	17	1 $\frac{1}{2}$
5	15	4 $\frac{1}{2}$	57	19	2 $\frac{1}{4}$	97	13	5 $\frac{1}{4}$	91	15	4 $\frac{1}{4}$
9	17	6 $\frac{1}{4}$	91	16	1	37	16	8 $\frac{1}{4}$	35	16	5 $\frac{3}{4}$
7	16	3	75	18	7 $\frac{1}{4}$	97	15	7	29	19	7 $\frac{1}{4}$
5	14	7 $\frac{3}{4}$	97	13	5	59	16	5 $\frac{1}{2}$	91	17	3 $\frac{1}{4}$
<hr/>			<hr/>			<hr/>			<hr/>		
39	6	7 $\frac{1}{4}$									
<hr/>			<hr/>			<hr/>			<hr/>		

MONEY.

M O N E Y.

£. s. d.	£. s. d.	£. s. d.	£. s. d.
257 .. 1 .. 5 $\frac{1}{2}$	525 .. 2 .. 4 $\frac{1}{4}$	21 .. 14 .. 7 $\frac{1}{4}$	73 .. 2 .. 1 $\frac{1}{2}$
734 .. 3 .. 7 $\frac{3}{4}$	179 .. 3 .. 5	75 .. 16 ..	25 .. 12 .. 7
595 .. 5 .. 3	250 .. 4 .. 7 $\frac{1}{4}$	79 .. 2 .. 4 $\frac{1}{2}$	96 .. 13 .. 5 $\frac{1}{2}$
159 .. 14 .. 7 $\frac{1}{2}$	975 .. 3 .. 5 $\frac{1}{4}$	57 .. 16 .. 5 $\frac{1}{2}$	76 .. 17 .. 3 $\frac{1}{4}$
207 .. 5 .. 4	254 .. 5 .. 7	26 .. 13 .. 8 $\frac{3}{4}$	97 .. 14 .. 1
798 .. 16 .. 7 $\frac{1}{4}$	379 .. 4 .. 5 $\frac{3}{4}$	54 .. 2 .. 7	54 .. 11 .. 7 $\frac{3}{4}$
<hr/>			
127 .. 4 .. 7 $\frac{1}{2}$	261 .. 17 .. 1 $\frac{1}{4}$	31 .. 1 .. 1 $\frac{1}{2}$	27 .. 13 .. 5
525 .. 3 .. 5	379 .. 13 .. 5	75 .. 13 .. 1	16 .. 7 .. 9 $\frac{1}{4}$
271 .. — .. 5	257 .. 16 .. 7 $\frac{3}{4}$	39 .. 19 .. 7 $\frac{1}{4}$	9 .. 15 .. 3
524 .. 9 .. 1	184 .. 13 .. 5	97 .. 17 .. 3 $\frac{1}{4}$	15 .. 2 .. 7 $\frac{1}{4}$
379 .. 4 .. 3 $\frac{1}{2}$	725 .. 2 .. 3 $\frac{1}{4}$	36 .. 13 .. 5	37 .. 19 .. 1
215 .. 5 .. 8 $\frac{1}{4}$	359 .. 6 .. 5	24 .. 16 .. 3 $\frac{1}{4}$	56 .. 19 .. 1 $\frac{3}{4}$
<hr/>			

T R O Y W E I G H T.

oz. dwt. gr.	oz. dwt. gr.	lb. oz. dwt.	lb. oz. dwt.
7 .. 15 .. 21	5 .. 11 .. 4	7 .. 1 .. 2	5 .. 2 .. 15
3 .. 17 .. 6	7 .. 19 .. 21	3 .. 2 .. 17	3 .. 11 .. 17
2 .. 5 .. 15	3 .. 15 .. 14	5 .. 1 .. 15	3 .. 7 .. 15
3 .. 16 .. 19	7 .. 19 .. 22	7 .. 10 .. 11	9 .. 1 .. 13
9 .. 18 .. 23	9 .. 18 .. 15	2 .. 7 .. 13	3 .. 9 .. 7
7 .. 15 .. 14	8 .. 13 .. 12	3 .. 11 .. 16	5 .. 2 .. 15
<hr/>			

AVOIRDUPOISE WEIGHT.

lb. oz. dr.	lb. oz. dr.	cwt. qrs. lb.	t. cwt. qrs.
152 .. 15 .. 15	17 .. 12 .. 3	25 .. 1 .. 17	7 .. 17 .. 2
272 .. 14 .. 10	23 .. 15 .. 6	72 .. 3 .. 26	5 .. 5 .. 3
303 .. 15 .. 11	31 .. 11 .. 14	54 .. 1 .. 16	2 .. 4 .. 1
255 .. 10 .. 4	97 .. — .. 9	24 .. 1 .. 16	3 .. 18 .. 2
973 .. 6 .. 2	48 .. 7 .. 15	17 .. — .. 19	7 .. 9 .. 3
635 .. 13 .. 13	79 .. 10 .. 6	55 .. 2 .. 16	8 .. 5 .. 1
<hr/>			

APOTHECARIES WEIGHT.

3	3	gr.	3	3	gr.	16	3	3	3	16	3	3	3										
7	..	1	..	17	9	..	2	..	-	17	7	..	2	..	1	..	-						
3	..	-	..	18	3	..	5	..	2	19	9	..	5	..	2	2	3	..	1	..	7	..	1
6	..	2	..	16	9	..	2	..	1	14	7	..	11	..	1	2	9	..	10	..	2	..	-
5	..	1	..	15	3	..	5	..	-	18	9	..	5	..	6	1	7	..	5	..	7	..	1
7	..	-	..	18	7	..	7	..	2	15	7	..	10	..	5	2	3	..	9	..	5	..	2
3	..	1	..	9	3	..	3	..	-	-	9	..	-	..	7	-	7	..	1	..	4	..	1

CLOTH MEASURE.

FF. qrs.	n.	yds. qrs.	n.	yds. qrs.	n.	EE. qrs.	n.				
27	2	1	35	3	3	73	3	2	72	2	1
15	1	3	70	2	2	97	1	3	52	1	2
37	-	2	95	3	-	54	-	2	79	-	1
52	1	3	76	1	3	76	2	-	56	2	-
76	2	1	26	-	1	59	1	3	79	3	1
97	1	3	79	2	1	76	2	2	54	2	1

LONG MEASURE.

<i>feet. in. bar.</i>	<i>yds. feet. in.</i>	<i>m. fur. p.</i>	<i>lea. m. fur.</i>
27 .. 9 .. 2	25 .. 1 .. 9	35 .. 7 .. 3	72 .. 2 .. 1
35 .. 10 .. 1	71 .. - .. 3	27 .. 5 .. 27	27 .. 1 .. 7
17 .. 2 .. 0	52 .. 2 .. 3	52 .. - .. 35	35 .. 2 .. 5
35 .. 11 .. 1	97 .. - .. 10	97 .. 1 .. 17	79 .. - .. 6
97 .. 2 .. 2	54 .. 2 .. 7	56 .. 7 .. 18	51 .. 1 .. 6
54 .. 8 .. 1	37 .. 1 .. 4	91 .. 5 .. 27	72 .. - .. 5

LAND MEASURE.

<i>c.</i>	<i>r.</i>	<i>p.</i>	<i>a.</i>	<i>r.</i>	<i>p.</i>	<i>a.</i>	<i>r.</i>	<i>p.</i>	<i>a.</i>	<i>r.</i>	<i>p.</i>
75	.. 3	.. 27	27	.. 1	.. 35	26	.. 1	.. 31	32	.. 1	.. 14
36	.. 2	.. 15	29	.. 2	.. 19	19	.. 2	.. 17	27	.. -	.. 19
97	.. 1	.. 16	37	.. 1	.. 15	55	.. 3	.. 14	31	.. 2	.. 15
35	.. 2	.. 15	95	.. 2	.. 27	79	.. 1	.. 21	19	.. 1	.. 18
27	.. 1	.. 14	62	.. -	.. 13	95	.. 2	.. 14	39	.. 2	.. 37

WINE MEASURE.

<i>run. gal. qts.</i>	<i>tier. gal. qts.</i>	<i>hbds. gal. qts.</i>	<i>T. hbds. gal.</i>
27 .. 17 .. 2	25 .. 36 .. 2	31 .. 57 .. 1	14 .. 3 .. 27
35 .. 15 .. 3	75 .. 41 .. 2	97 .. 18 .. 2	19 .. 2 .. 56
56 .. 14 .. 1	62 .. 15 .. 1	76 .. 13 .. 1	17 .. - .. 39
97 .. 10 .. 3	94 .. 13 .. 2	55 .. 46 .. 2	75 .. 2 .. 16
92 .. 15 .. -	15 .. 14 .. 3	87 .. 38 .. 3	54 .. 1 .. 19
79 .. 3 .. 1	19 .. 17 .. 1	55 .. 17 .. 1	97 .. 3 .. 54

ALE and BEER MEASURE.

<i>A.B. fir. gal.</i>	<i>B.B. fir. gal.</i>	<i>hbd. gal. qt.</i>	<i>hbd. gal. qt.</i>
25 .. 2 .. 7	37 .. 2 .. 8	76 .. 51 .. 2	76 .. 2 .. 1
17 .. 3 .. 5	54 .. 1 .. 7	57 .. 3 .. 3	95 .. 35 .. 2
96 .. 2 .. 6	97 .. 3 .. 8	97 .. 27 .. 3	57 .. 16 .. 3
75 .. 1 .. 4	78 .. 2 .. 5	22 .. 17 .. 2	22 .. 14 .. 1
96 .. 3 .. 7	47 .. - .. 7	32 .. 19 .. 3	32 .. 37 .. 3
75 .. - .. 5	35 .. 2 .. 5	55 .. 38 .. -	55 .. 16 .. 1

DRY MEASURE.

<i>qr. bu. p.</i>	<i>qr. bu. p.</i>	<i>ch. bu. p.</i>	<i>ch. bu. p.</i>
75 .. 7 .. 2	36 .. 2 .. 1	75 .. 27 .. 2	73 .. 2 .. 1
37 .. 2 .. 3	71 .. - .. 3	57 .. 3 .. 1	41 .. 24 .. 1
51 .. 2 .. -	53 .. 6 .. -	95 .. 25 .. 3	92 .. 16 .. 1
79 .. 7 .. 1	82 .. 4 .. 1	76 .. 35 .. 2	70 .. 13 .. 2
55 .. - .. 3	95 .. 3 .. 3	97 .. 25 .. 1	54 .. 17 .. 3
96 .. 2 .. 1	78 .. 2 .. 1	75 .. 16 .. 3	79 .. 25 .. 1

T I M E.

<i>hs. m. "</i>	<i>d. b. m.</i>	<i>w. d. h.</i>	<i>w. d. h.</i>
52 .. 57 .. 35	72 .. 23 .. 27	71 .. 3 .. 11	57 .. 2 .. 15
97 .. 16 .. 27	54 .. 15 .. 35	51 .. 2 .. 9	95 .. 3 .. 21
16 .. 58 .. 45	97 .. 13 .. 31	76 .. - .. 21	76 .. - .. 15
96 .. 18 .. 31	58 .. 21 .. 45	95 .. 3 .. 21	53 .. 2 .. 21
75 .. 35 .. 21	96 .. 20 .. 48	79 .. 1 .. 15	98 .. 2 .. 18

The APPLICATION.

1. A man born in the year 1750, when will he be 47 years of age?

Ans. 1797.

2. *A, B, C, D*, went partners in the purchase of a quantity of goods; *A* laid out £7. half a guinea, and a crown, *B* 49s. *C* 54s. 6d. and *D* 87d. What was laid out in all?

Ans. £13..6..3.

3. A man lent his friend at different times these several sums, *viz.* £63, £25..15, £32..7, £15..14..10, and four-score and nineteen pounds, half a guinea, and a shilling. How much did he lend in all?

Ans. £236..8..4.

4. What's the estate worth *per annum*, when the taxes are 21 guineas, the neat income 8 score, £19..14?

Ans. £201..15.

5. There are three numbers; the first 215, the second 519, and the third is as much as the other two. What is the sum of them all?

Ans. £1468.

6. Bought a parcel of goods, for which I paid £54..17, for packing 13s. 8d. carriage £1..5..4, and spent about the bargain 14s. 3d. What do these goods stand me in?

Ans. £57..10..3.

7. There are two numbers, the least whereof is 40, their difference 14. I desire to know what is the greater number, and the sum of both?

Ans. 54 greater number, 94 sum.

8. A gentleman left his eldest daughter £1500 more than the youngest, and her fortune was 11 thousand, 11 hundred and £11. What was the eldest sister's fortune, and what did the father leave them?

Ans. Eldest sister's fortune £13611. Father left them £25722.

SUBTRACTION of MONEY, WEIGHTS, and MEASURES.

RULE. Subtract as in Integers: only when any of the lower denominations are greater than the upper, borrow as many of that as make one of the next superior, adding it to the upper, from which take the less; set down the difference, and carry 1 to the next higher denomination for what you borrowed.

PROOF. As in Integers.

MONEY.

M O N E Y.

Borrowed £. s. d.
715 .. 2 .. 7 $\frac{1}{4}$

Paid 476 .. 3 .. 8 $\frac{1}{2}$

Lent £. s. d.
316 .. 3 .. 5 $\frac{1}{2}$

Received 218 .. 2 .. 1 $\frac{3}{4}$

Remains to pay 238 .. 18 .. 10 $\frac{3}{4}$

Proof 715 .. 2 .. 7 $\frac{1}{4}$

£. s. d. £. s. d.
87 .. 2 .. 10 3 .. 15 .. 1 $\frac{1}{2}$
79 .. 3 .. 7 $\frac{1}{2}$ 1 .. 14 .. 7

£. s. d. £. s. d.
25 .. 2 .. 5 $\frac{1}{2}$ 37 .. 3 .. 4 $\frac{1}{4}$
17 .. 9 .. 8 $\frac{1}{2}$ 27 .. 5 .. 2 $\frac{1}{4}$

£. s. d. £. s. d.
321 .. 17 .. 1 $\frac{1}{2}$ 59 .. 15 .. 2 $\frac{1}{2}$
257 .. 14 .. 7 36 .. 17 .. 2 $\frac{1}{2}$

£. s. d. £. s. d.
71 .. 2 .. 4 527 .. 3 .. 5 $\frac{1}{2}$
19 .. 13 .. 7 $\frac{3}{4}$ 139 .. 5 .. 7 $\frac{1}{4}$

Borrowed 25107 .. 15 .. 7

Lent 250156 .. 1 .. 6

Paid 375 .. 5 .. 5 $\frac{1}{4}$
at 259 .. 2 .. 7 $\frac{1}{2}$
at 359 .. 13 .. 4 $\frac{3}{4}$
different 523 .. 17 .. 3
times 274 .. 15 .. 7 $\frac{1}{4}$
325 .. 13 .. 5

Received 271 .. 13 .. 7 $\frac{1}{4}$
at 359 .. 15 .. 3
at 475 .. 13 .. 9 $\frac{3}{4}$
several 527 .. 15 .. 3 $\frac{1}{4}$
payments 272 .. 16 .. 5
150 .. — .. —

Paid in all

Remains to pay

T R O Y W E I G H T.

oz. dt. gr. oz. dt. gr. lb. oz. dt. gr. lb. oz. dt. gr.
Bought 27 .. 15 .. 2 7 .. 5 .. 15 52 .. 1 .. 7 .. 2 7 .. 2 .. 2 .. 5
Sold 21 .. 14 .. 7 6 .. 7 .. 14 39 .. — .. 15 .. 7 5 .. 7 .. 1 .. 7

Unfold

A V O I R D U P O I S E W E I G H T.

lb. oz. dr. lb. oz. dr. cwt. qrs. lb. T. cwt. qrs. lb.
25 .. 11 .. 15 35 .. 10 .. 5 35 .. 1 .. 21 21 .. 1 .. 2 .. 7
17 .. 9 .. 13 29 .. 12 .. 7 25 .. 1 .. 20 9 .. 1 .. 3 .. 5

APOTHECARIES WEIGHT.

3 3 3 gr. 3 3 3 gr. 15 3 3 3 15 3 3 3
27..1..-..1 3..1..2..4 5..2..1..- 9..7..2..1
15..2..-..7 1..-..-..7 2..5..2..1 5..7..3..1

CLOTH MEASURE.

EF	qrs.	n.	yds.	qrs.	n.	yds.	qrs.	n.	EE	qrs.	n.								
35	..	2	..	2	47	..	1	..	-	71	..	1	..	2	35	..	2	..	1
17	..	2	..	1	35	..	2	..	2	3	..	2	..	1	14	..	3	..	2

LONG MEASURE.

f.	in.	bar.	yds.	f.	in.	m.	fur.	p.	l.	m.	f.	p.									
25	..	1	..	-	37	..	2	..	1	52	..	1	..	27	71	..	1	..	7	..	—
17	..	2	..	2	15	..	2	..	7	25	..	7	..	34	50	..	-	..	3	..	27

LAND MEASURE.

<i>a.</i>	<i>r.</i>	<i>p.</i>	<i>a.</i>	<i>r.</i>	<i>p.</i>	<i>a.</i>	<i>r.</i>	<i>p.</i>	<i>a.</i>	<i>r.</i>	<i>p.</i>							
75	..	1	..	27	37	..	1	..	27	25	.. - .. 1	325	..	2	..	1		
39	..	-	..	27	35	..	2	..	15	17	..	1	.. -	379	..	3	..	5

WINE MEASURE.

tun. gal. qts.	tier. gal. qts.	bhd. gal. qts.	tun. bhd. gal.
72 .. 1 .. 1	27 .. 27 .. 1	75 .. 57 .. 1	79 .. 2 .. 14
35 .. 1 .. 2	19 .. 35 .. 2	57 .. 59 .. 1	35 .. 3 .. 27

ALE *and* BEER MEASURE.

<i>A.B. fir. gal.</i>	<i>BB. fir. gal.</i>	<i>hbd. gal. qts.</i>	<i>hbd. gal. qts.</i>
25 .. 1 .. 2	37 .. 2 .. 1	27 .. 27 .. 1	709 .. 2 .. 1
21 .. 1 .. 5	25 .. 1 .. 7	12 .. 50 .. 2	157 .. 2 .. 2

DRY MEASURE.

<i>qu.</i>	<i>bu.</i>	<i>p.</i>	<i>qu.</i>	<i>bu.</i>	<i>p.</i>	<i>ch.</i>	<i>bu.</i>	<i>p.</i>	<i>ch.</i>	<i>bu.</i>	<i>p.</i>
72	.. 1	.. 2	65	.. 2	.. 1	79	.. 3	.. -	35	.. 3	.. 3
35	.. 2	.. 3	57	.. 2	.. 3	54	.. 7	.. 1	23	.. 5	.. 1

T I M E.

<i>b.</i>	<i>m.</i>	<i>"</i>	<i>d.</i>	<i>b.</i>	<i>m.</i>	<i>m.</i>	<i>w.</i>	<i>d.</i>	<i>m.</i>	<i>w.</i>	<i>d.</i>
75	.. 1	.. 27	72	.. 1	.. 51	35	.. 2	.. 1	65	.. 2	.. 1
52	.. 7	.. 31	36	.. 3	.. 27	17	.. 3	.. 5	14	.. 1	.. 1

The APPLICATION.

1. A man born in the year 1723, what was his age in the year 1781? *Ans.* 58.
2. What is the difference between the age of a man born in 1710, and another born in 1766? *Ans.* 56.
3. A merchant had five debtors, *A*, *B*, *C*, *D*, and *E*; which together owed him £ 1156; *B*, *C*, *D*, and *E*, owed him £ 737: What was *A*'s debt? *Ans.* £ 419.
4. When an estate of £ 300 *per annum* is reduced, on paying of taxes, to 12 score and £ 14..6: What is the tax? *Ans.* £ 45..14.
5. What is the difference between 9154, and the amount of 754 added to 305. *Ans.* 8095.
6. A horse in his furniture is worth £ 37..5; out of it, 14 guineas: How much does the price of the furniture exceed that of the horse? *Ans.* £ 7..17.
7. A merchant, at his out-setting in trade, owed £ 750; he had in cash, commodities, the stocks, and good debts, £ 12510..7; he cleared the first year by commerce, £ 452..3..6: What was the neat balance at the 12 month end? *Ans.* £ 12212..10..6.
8. A gentleman dying left £ 45247, between two daughters; the youngest was to have 15 thousand, 15 hundred, and twice £ 15: What was the elder sister's fortune? *Ans.* £ 28717.

MULTIPLICATION *of several* DENOMINATIONS.

RULE. Multiply the first denomination by the quantity given, dividing the product by as many of that as make one of the next, setting down the remainder, and add the quotient to the next superior, after it is multiplied.

If the given quantity is above 12, multiply by any two numbers, which multiplied together, will make the same number; but if no two numbers multiplied together will make the exact number; then multiply the top line by as many as is wanting; adding it to the last product.

PROOF. By Division.

£.	$s.$	$d.$	£.	$s.$	$d.$	£.	$s.$	$d.$	£.	$s.$	$d.$
35	..	12	..	7	$\frac{1}{4}$	75	..	13	..	1	$\frac{1}{2}$
<hr/>			<hr/>			<hr/>			<hr/>		
2			5			4			5		
<hr/>			<hr/>			<hr/>			<hr/>		
71	..	5	..	2	$\frac{1}{2}$						
<hr/>			<hr/>			<hr/>			<hr/>		

24 Multiplication.

The TUTOR'S

lb.	oz.	dwt.	gr.	ton.	cwt.	qrs.	lb.	yds.	qrs.	n.	m.	fur.	p.
8	..	5	..	17	..	4	25	..	7	..	2	..	1
							7						5

<i>a.</i>	<i>r.</i>	<i>p.</i>	<i>A.B. fir. gal.</i>	<i>B.B. fir. gal.</i>	<i>m. fur. p.</i>
7	..	2 .. 1	32 .. 1 .. 7	26 .. 2 .. 7	54 .. 2 .. 1
		9	7	3	5

1. 18 yds. of cloth at 9s. 6d.	2. 26lb. of tea, at £1 .. 2 .. 6
per yd.	per lb
9 + 2 = 18	8 × 3 + 2 = 26

4 .. 5 .. 6	9 .. - .. -
2	3
8 .. 11 .. -	27 .. - .. -
	Top line × 2
	2 .. 5 .. -
	29 .. 5 .. -

- 21 ells of holland at 7s. 8d. $\frac{1}{2}$ per ell.
Facit £ 8..1..10 $\frac{1}{2}$.
- 35 firkins of butter, at 15s. 3d. $\frac{1}{2}$ per firkin.
Facit £ 26..15..2 $\frac{1}{2}$.
- 75 lb. of nutmegs, at 7s. 2d. $\frac{3}{4}$ per lb.
Facit £ 27..2..2 $\frac{1}{4}$.
- 37 yards of tabby, at 9s. 7d. per yard.
Facit £ 17..14..7.
- 97 cwt of cheefe, at £1..5..3 per cwt.
Facit £ 122..9..3.
- 43 dozen of candles, at 6s. 4d. per dozen.
Facit £ 13..12..4.
- 127 lb. of bohea tea, at 12s. 3d. per lb.
Facit £ 77..15..9.
- 135 gallons of rum at 7s. 5d. per gallon.
Facit £ 50..1..3.
- 74 ells of diaper, at 1s. 4d. $\frac{1}{2}$ per ell.
Facit £ 5..1..9.
- 6 dozen pair of gloves, at 1s. 10d. per pair.
Facit £ 6..12.

When the given quantity consists of $\frac{1}{2}$, $\frac{1}{4}$, divide the price by $\frac{1}{2}$, $\frac{1}{4}$; when $\frac{3}{4}$, divide the price by $\frac{1}{2}$, and that quotient by $\frac{3}{2}$; which add to the product of the quantity given.

DR'S

13. $25\frac{1}{2}$ ells of holland, at 3s. $4\frac{1}{2}$ d. per ell.

$$\begin{array}{r} 5 \quad 5 \times 5 = 25 \end{array}$$

$$\begin{array}{r} 16 \dots 10\frac{1}{2} \\ \hline 5 \end{array}$$

$$\begin{array}{r} 4 \dots 4 \dots 4\frac{1}{2} = 25 \\ - \dots 1 \dots 8\frac{1}{4} = \frac{1}{2} \end{array}$$

$$\begin{array}{r} 4 \dots 6 \dots -\frac{1}{4} = 25\frac{1}{2} \end{array}$$

14. $75\frac{1}{2}$ ells of diaper, at 1s. 3d. per ell.

$$\text{Facit } \pounds 4..14..4\frac{1}{2}.$$

15. $19\frac{1}{2}$ ells of damask, at 4s. 3d. per ell.

$$\text{Facit } \pounds 4..2..10\frac{1}{2}.$$

16. $35\frac{1}{2}$ ells of dowlas, at 1s. 4d. per ell.

$$\text{Facit } \pounds 2..7..4.$$

17. $7\frac{1}{4}$ cwt. of Malaga raisins, at $\pounds 1..1..6$. per cwt.

$$\text{Facit } \pounds 7..15..10\frac{1}{2}.$$

18. $6\frac{1}{2}$ barrels of herrings, at $\pounds 3..15..7$. per barrel.

$$\text{Facit } \pounds 24..11..3\frac{1}{2}.$$

19. $35\frac{1}{2}$ cwt. of double refined sugar, at $\pounds 4..15..6$ per cwt.

$$\text{Facit } \pounds 169..10..3.$$

20. $154\frac{1}{2}$ cwt. of tobacco, at $\pounds 4..17..10$. per cwt.

$$\text{Facit } \pounds 755..15..3.$$

21. $117\frac{1}{4}$ gallons of arrack, at 12s. 6d. per gallon.

$$\text{Facit } \pounds 73..5..7\frac{1}{2}.$$

22. $85\frac{3}{4}$ cwt of cheese, at $\pounds 1..7..8$. per cwt.

$$\text{Facit } \pounds 118..12..5.$$

23. $29\frac{1}{4}$ lb. of fine hyson tea, at $\pounds 1..3..6$. per lb.

$$\text{Facit } \pounds 34..7..4\frac{1}{2}.$$

24. $17\frac{3}{4}$ yards of superfine scarlet drab, at $\pounds 1..3..6$. per yd.

$$\text{Facit } \pounds 20..17..1\frac{1}{2}.$$

25. $37\frac{1}{2}$ yds. of rich brocaded silk, at 12s. 4d. per yd.

$$\text{Facit } \pounds 23..2..6.$$

26. $56\frac{3}{4}$ cwt. of sugar, at $\pounds 2..18..7$. per cwt.

$$\text{Facit } \pounds 166..4..7\frac{1}{4}.$$

27. $96\frac{1}{2}$ cwt of currants, at $\pounds 2..15..6$. per cwt.

$$\text{Facit } \pounds 267..15..9.$$

28. $45\frac{3}{4}$ lb. of Belladine filk, at 18s. 6d. per lb.

$$\text{Facit } \pounds 42..6..4\frac{1}{2}.$$

29. 87 bushels $\frac{3}{4}$ of wheat, at 4s. 3d. per bushel.

$$\text{Facit } \pounds 18..12..11\frac{1}{4}.$$

30. $120\frac{3}{4}$ cwt. of hops, at $\pounds 4..7..6$. per cwt.

$$\text{D Facit } \pounds 528..5..7\frac{1}{2}.$$

The APPLICATION.

1. What sum of money must be divided amongst 18 men, so that each may receive £14..6..8½?

Ans. £258..-..9.

2. A privateer of 250 men took a prize, which amounted to £125..15..6. to each man, what was the value of the prize?

Ans. £31443..15..-

3. What is the difference between six dozen dozen and half a dozen dozen; and what is their sum and product?

Ans. 792 Diff. Sum 936, Product 62208.

4. What difference is there between twice eight and fifty, and twice fifty-eight, and what's their product?

Ans. 50 Diff. 7656 Prod.

5. There are two numbers, the greater of them is 37 times 45, and their differences 19 times 4; their sum and product are required?

Ans. 3254 Sum, 2645685 Prod.

6. The sum of two numbers is 360, the less of them 144: what is their product, and the square of their difference?

Ans. 31104 Product, 5184 Square of their difference.

7. If an army, consisting of 187 squadrons of horse, each 157 men, and 207 battalions, each 560 men, how many effective soldiers, supposing that in seven hospitals there are 473 sick?

Ans. 144806.

8. What sum did that gentleman receive in dowry with his wife, whose fortune was her wedding suit: her petticoat having two rows of furbelows, each furbelow 87 quills, and each quill 21 guineas?

Ans. £3836..14..-

9. A merchant had £19118 to begin trade with: for 5 years together he cleared £1086 a-year; the next 4 years he made good £2715..10..6 a year; but the last 3 years he was in trade had the misfortune to lose, one year with another, £475..4..6 a year; what was his real fortune at 12 years end?

Ans. £33984..8..6.

DIVISION of several DENOMINATIONS.

RULE. Divide the first denomination on the left hand; and, if any remains, multiply them by as many of the next less as make one of that, which add to the next, and divide as before.

PROOF. By Multiplication.

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
2)25..	2..	4(	3)37..	7..	7(	4)57..	5..	7(	5)52..	7..	(3
<hr/>			<hr/>			<hr/>			<hr/>		
12..			11..			2					
<hr/>			<hr/>			<hr/>			<hr/>		

ASSISTANT.

Division. 27

lb. oz. dwt gr.	lb. oz. dr.	T. cwt. qrs. lb.
7)75 .. 3 .. 7 .. 5(yds. qrs. n.	8)35 .. 14 .. 13(m. f. p.	6)5 .. 10 .. 1 .. 13(yds. ft. inch.
11)35 .. 1 .. 3(A.B. fir. gal.	9)76 .. 3 .. 27(B.B. fir. gal.	12)75 .. 2 .. 9(cb. bu. pk.
12)35 .. 2 .. 5(	-9)55 .. 3 .. 7(	11)357 .. 2 .. 1(

The APPLICATION.

1. If a man spends £257..2..5. in 12 month's time, what is that *per month*?
Ans. £21..8..6 $\frac{1}{2}$

2. The cloathing of 35 charity boys came to £57..3..7. What is the expence of each?
Ans. 1..12..8.

3. If I give £37..6..4 $\frac{3}{4}$ for 9 pieces of cloth, what did I give *per piece*?
Ans. £4..2..11.

4. If 20 cwt. of tobacco came to £27..5..4 $\frac{1}{2}$, at what rate is that *per cwt.*?
Ans. £1..7..3.

5. What is the value of 1 hogfhead of beer, when 120 are sold for £154..17..10?
Ans. £ 1..5..9 $\frac{3}{4}$.

6. Bought 72 yards of cloth for £85..6..-, I desire to know at what rate *per yard*?
Ans. £1..3..8 $\frac{1}{4}$.

7. Gave £275..3..4. for 36 bales of cloth. What is that for 2 bales?
Ans. £15..5..8 $\frac{3}{4}$.

8. A prize of £7257..3..6. is to be equally divided amongst 500 sailors. What is each man's share?
Ans. £14..10..3 $\frac{1}{4}$.

9. There are 2545 bullocks to be divided among 509 men. I desire to know how many each man had, and the value of each man's share, supposing every bullock worth £9..14..6?
Ans. 5 bullocks each man, £48..12..6. each share.

10. A gentleman has a garden walled in, containing 9625 yards; the breadth was 35 yards. What was the length?
Ans. 275.

11. A club in London, consisting of 25 gentlemen, joined for a lottery ticket of £10. value, which came up a prize of £4000. I desire to know what each man contributed, and what each man's share came to?
Ans. each contributed 8s. each share £160.

12. A trader cleared £1156, equally in 17 years. How much did he lay by in a year?
Ans. £68.

13. Another cleared £2805, in 7 $\frac{1}{2}$ years. What was his yearly increase of fortune?
Ans. £374.

14. What number added to the 43d part of 4429 will raise it to 240? *Ans.* 137.

15. Divide 20s. between A, B, and C, in such sort that A may have 2s. less than B, and C, 2s. more than B.

Ans. A. 4s. 8d. B. 6s. 8d. C. 8s. 8d.

16. If there are 1000 men to a regiment, and but 50 officers, how many private men are there to one officer?

Ans. 19.

17. What number is that which multiplied by 7847 will make the product 3013248? *Ans.* 384.

18. The quotient is 1083, the divisor 28604, what was the dividend, if the remainder came out 1788?

Ans. 30979920.

BILLS of PARCELS.

HOSIER'S.

Mr. John Thomas

Bought of Samuel Green, March 7, 1782.

		s.	d.	
8	Pair of worsted stockings, at	4	.. 6	per pair £
5	pair of thread ditto - at	3	.. 2	- - -
3	Pair of black silk ditto - at	14	.. 0	- - -
6	Pair of milled hose - at	4	.. 2	- - -
4	Pair of cotton ditto - at	7	.. 6	- - -
2	Yards of fine flannel - at	1	.. 8	- - -

£ 7.. 12 .. 2

MERCER'S.

Mr. Isaac Grant

Bought of John Sims, March 12, 1782.

		s.	d.	
15	Yards of sattin - at	9	.. 6	per yard £
18	Yards of flowered silk at	17	.. 4	- - -
12	Yards of rich brocade at	19	.. 8	- - -
16	Yards of farfenet - at	3	.. 2	- - -
13	Yards of Genoa velvet at	27	.. 6	- - -
23	Yards of lutestring - at	6	.. 3	- - -

£ 62 .. 2 .. 5

L I N E N

L I N E N - D R A P E R ' S .

Mr. Simon Surety

Bought of Josiah Short, March 27, 1782.

			s.	d.	
4	Yards of cambrick	- at	12	.. 6	per yard £
12	Yards of muslin	- at	8	.. 3	- - -
15	Yards of printed linen	at	5	.. 4	- - -
2	Dozen of napkins	- at	2	.. 3	each -
14	Ells of diaper	- - at	1	.. 7	per ell -
35	Ells of dowlas	- - at	1	.. 1½	- - -

£ 17 .. 4 .. 6½

M I L L I N E R ' S .

Mrs. Bright

Bought of Lucy Brown, April 5, 1782.

			l.	s.	d.	
18	Yards of fine lace	- at	-	.. 12	.. 3	per yard £
5	Pair of fine kid gloves	- at	-	.. 2	.. 2	per pair
12	Fans of French mounts	at	-	.. 3	.. 6	each
2	Fine laced tippets	- at	-	.. 3	.. 3	- - -
4	Dozen Irish lamb	- at	-	.. 1	.. 3	per pair
6	Sets of knots	- - at	-	.. 2	.. 6	per set

£ 23 .. 14 .. 4

W O O L L E N - D R A P E R ' S .

Mr. Thomas Sage

Bought of Ellis Smith, April 7, 1782.

			l.	s.	d.	
17	Yards of fine serge	- at	-	.. 3	.. 9	per yard £
18	Yards of drugget	- - at	-	.. 9	.. -	- - -
15	Yards of superfine scarlet	at	1	.. 2	.. -	- - -
16	Yards of black	- - at	-	.. 18	.. -	- - -
25	Yards of shalloon	- - at	-	.. 1	.. 9	- - -
17	Yards of drab	- - at	-	.. 17	.. 6	- - -

£ 59 .. 5 .. -

LEATHER-SELLER'S.

Mr. Giles Harris

Bought of Abel Smith, April 15, 1782.

			s.	d.	
27	Calf skins	- - at	3	9	per skin £
75	Sheep ditto	- - at	1	7	- - -
36	Coloured ditto	- - at	1	8	- - -
15	Buck ditto	- - at	11	6	- - -
17	Russia hides	- - at	10	7	each -
120	Lamb skins	- - at	1	2	$\frac{1}{2}$ - -
					<hr/>
					£ 38 .. 17 .. 5

GROCER'S.

Mr. Richard Groves

Bought of Francis Elliot, April 21, 1782.

			s.	d.	
25	lb. of lump sugar	- at	-	6	$\frac{1}{2}$ per lb. £
2	Loaves of double re-	} at	-	11	$\frac{1}{2}$ - -
	finer, weight 15 lb.				
14	lb. of rice	- at	-	3	- -
28	lb. of Malaga raisins	at	-	5	- -
15	lb. of currants	- at	-	5	$\frac{1}{2}$ - -
7	lb. of black pepper	- at	1	10	- -
					<hr/>
					£ 3 .. 2 .. 9 $\frac{1}{2}$

CHEESEMONGER'S.

Mr. Charles Crofs

Bought of Samuel Grant, April 23, 1782.

			s.	d.	
8	lb. of Cambridge butter	at -	6		per lb. £
17	lb. of new cheese	- at -	4		- -
$\frac{1}{2}$	Firkin of butter, wt. 28 lb.	at -	5	$\frac{1}{2}$	- -
5	Cheshire cheeses, wt.	} at -	4		- -
127	lb				
2	Warwickshire do. wt.	} at -	3		- -
15	lb				
12	lb. of cream cheese	- at -	6		- -
					<hr/>
					£ 3 .. 14 .. 7

CORN-CHANDLER'S.

Mr. Abraham Doyley

Bought of Isaac Jones, April 29, 1782.

			s.	d.	
Tares,	19 bushels	- at	1 ..	10	per bushel £
Peas,	18 bushels	- at	3 ..	9½	- - -
Malt,	7 quarters	- at	25 ..	-	per quarter
Hops,	15 lb	- at	1 ..	5	per lb.
Oats,	6 quarters	- at	2 ..	4	per bushel -
Beans,	12 bushels	- at	4 ..	8	- - -
					<hr/>
					£ 18 .. 9 .. 4
					<hr/>

REDUCTION

IS the bringing or reducing numbers of one denomination into other numbers of another denomination, retaining the same value, and is performed by multiplication and division.

First, All great names are brought into small, by multiplying with so many of the less as make one of the greater.

Secondly, All small names are brought into great, by dividing with so many of the less as make one of the greater.

A TABLE of such COINS as are current in England.

	l.	s.	d.
Guinea	- - 1 ..	1 ..	-
Half ditto	- - - ..	10 ..	6
Quarter ditto	- - - ..	5 ..	3
Crown	- - - ..	5 ..	-
Half ditto	- - - ..	2 ..	6
Shilling	- - - ..	1 ..	-

Note, There are several pieces which speak their own value: such as six-pence, four-pence, three-pence, two-pence, penny, halfpenny, farthing.

REDUCTION

REDUCTION *Descending.*

1. In £ 8 how many shillings and pence ?

$$\begin{array}{r}
 20 \\
 \hline
 160 \text{ shillings.} \\
 12 \\
 \hline
 1920 \text{ pence.} \\
 \hline
 \end{array}$$

2. In £ 12 how many shillings, pence, and farthings ?

Ans. 240s. 2880d. 11520 far.

3. How many shillings, pence, and farthings, are there in £ 18 ?

Ans. 360s. 4320d. 17280 far.

4. Reduce £ 7 and a crown into shillings and pence.

Facit 145s. 1740d.

5. How many farthings are there in 21 guineas ?

Ans. 21168.

6. In £ 17.. 5.. 3
- $\frac{1}{4}$
- how many farthings ?

Ans. 16573.

7. In £ 25.. 14.. 1 how many shillings and pence ?

Ans. 514s. 6169d.

8. In 15 crowns, how many shillings and sixpences ?

Ans. 75s. 150 sixpences.

9. How many crowns and shillings in £ 25 ?

Ans. 100 crowns, 500s.

10. In 57 half-crowns, how many pence and farthings ?

Ans. 1710d. 6840 farthings.

11. In 52 crowns, as many half-crowns, shillings and pence, how many farthings ?

Ans. 21424.

12. How many half-crowns, sixpences, and threepences are there in £ 75 ?

Ans. 600 half-crowns, 3000 sixpences, 6000 threepences.REDUCTION *Ascending.*

13. In 1920 pence, how many shillings and pounds ?

Ans. 160s. £ 8.

$$12)1920$$

$$20)160(\text{ shillings.}$$

14. In 11520 farthings, how many pence, shillings, and pounds?
Ans. 2880d. 240s. £ 12.

15. How many pence, shillings, and pounds, are there in 17280 farthings?
Ans. 4320d. 360s. £ 18.

16. Reduce 1740 pence into shillings and pounds.

Facit 145s. £ 7..5.

17. How many guineas in 21168 farthings?

Ans. 21 guineas.

18. In 16573 farthings, how many pounds?

Ans. £ 17..5..3 $\frac{1}{4}$.

19. In 6169 pence, how many shillings and pounds?

Ans. 514s. 25..14..1.

20. In 900 pence, how many shillings and crowns?

Ans. 75s. 15 crowns.

21. How many crowns and pounds in 500 shillings?

Ans. 100 crowns £ 25.

22. In 6840 farthings, how many pence and half-crowns?

Ans. 1710d. 57 half-crowns.

23. In 21424 farthings, how many crowns, half-crowns, shillings, and pence, and of each an equal number?

Ans. 52.

24. How many sixpences, half-crowns, and pounds, in 6000 threepences?

Ans. 3000 sixpences, 600 half-crowns, £ 75.

Ascending and Descending.

25. In 1560 pence, how many crowns and shillings?

Ans. 26 crowns, 130s.

610) 15610

26

5

130

26. Reduce 130 shillings into crowns and pence.

Facit 26 crowns, 1560d.

27. How many shillings, crowns, and pounds in 60 guineas?

Ans. 1260s. 252 crowns, £ 63.

28. In £ 63, how many crowns, shillings, and guineas?

Ans. 252 crs. 1260s. 60 gui.

29. Reduce 76 moidores into shillings and pounds.

Facit 2052s. £ 102..12.

30. Reduce £ 102..12 into shillings and moidores.

Facit 2052s. 76 moidores.

31. How many shillings, half-crowns, and crowns, are there in £ 556, and of each an equal number?

Ans. 1308 each, and 2s. over.

32. In 1308 half-crowns, as many crowns and shillings, how many pounds?

Ans. £555..18.

33. Seven men bought £ 15..10 each into the mint, to be changed for guineas: How many must they have in all?

Ans. 103 guineas, 7s. over.

34. If 103 guineas and 7 shillings are to be divided amongst 7 men: How many pounds sterling is that to each?

Ans. 15..10.

35. A certain person had 25 purses, and in each purse 12 guineas, a crown, and a moidore, how many pounds sterling had he in all?

Ans. £ 355.

36. A gentleman, in his will, leaves £ 50 to the poor, and ordered that $\frac{1}{3}$ should be given to ancient men, each to have 5s.— $\frac{1}{4}$ to poor women, each to have 2s. 6d.— $\frac{1}{5}$ to poor boys, each to have 1s.— $\frac{1}{8}$ to poor girls, each to have 9d. and the remainder to the person that distributed it. I demand how many of each sort there were, and what the person that distributed the money had for his pains?

Ans. 66 men, 100 women, 200 boys, 222 girls, £ 2..13..6 to the person.

T R O Y W E I G H T.

37. In 27 ounces of gold, how many grains?

Ans. 12960.

38. In 12960 grains of gold, how many ounces?

Ans. 27.

39. In 3 lb. 10 oz. 7 dwts. 5 gr. how many grains?

Ans. 22253.

40. In 8 ingots of silver, each weighing 7 lb. 4 oz. 17 dwt. 15 gr. how many ounces, pennyweights, and grains?

Ans. 711 oz. 14221 dwt. 341304 gr.

41. How many ingots of 7 lb. 4 oz. 17 dwt. 15 gr. each are there in 341304 grains?

Ans. 8 ingots.

42. Bought 7 ingots of silver, each containing 23 lb. 5 oz. 7 dwt. how many grains?

Ans. 945336.

43. A gentleman sent a tankard to his goldsmith, that weighed 50 oz. 8 dwt. and ordered him to make it into spoons, each to weigh 2 oz. 16 dwt. How many had he?

Ans. 18.

44. A gentleman delivered to a goldsmith 137 oz. 6 dwt. 9 gr. of silver, and ordered him to make it into tankards of 17 oz. 15 dwt. 10 gr. each, spoons of 21 oz. 11 dwt. 13 gr. per doz. salts of 3 oz. 10 dwt. each, and forks of 21 oz. 11 dwt. 13 gr. per dozen; and, for every tankard, to have one salt, a dozen of spoons, and a dozen of forks: What is the number of each he must have?

Ans. Two of each sort, 8 oz. 9 dwt. 9 gr. over.

AVOIRDUPOISE WEIGHT.

Note, *There are several sorts of silk which are weighed by a great pound of 24 oz. others by the common pound of 16 oz. therefore,*

To bring great pounds into common, multiply by 3, and divide by 2, or add one half.

To bring small pounds into great, multiply by 2, and divide by 3, or subtract one third.

Things bought and sold by the Tale.

<i>Dozens.</i>		<i>Paper and Parchment.</i>	
12 Pieces or things make	1 Doz.	24 Sheets make	1 Quire
12 Dozen - - -	- 1 Groce	20 Quire -	1 Ream
12 Groce or 144 doz.	{	1 Great	2 Reams - 1 Bundle
		Groce	1 Dozen of Par. 12 Skins
		12 Skins -	1 Roll

45. In 14769 ounces: How many cwt?

Ans. 8 cwt. 0 qr. 27 lb. 1 oz.

46. Reduce 8 cwt. 0 qr. 27 lb. 1 oz. into quarters, pounds, and ounces.

Facit 32 qrs. 923 lb. 14769 oz.

47. Bought 32 bags of hops, each 2 cwt. 1 qr. 14 lb. and another of 150 lb. How many cwt. in the whole?

Ans. 77 cwt. 1 qr. 10 lb.

48. In 34 ton, 17 cwt. 1 qr. 19 lb. how many pounds?

Ans. 78111 lb.

49. In 350 great pounds, how many common? *Ans. 525 lb.*

50. In 27 cwt. of raisins, how many parcels of 18 lb. each?

Ans. 168.

51. In 9 cwt. 2 qrs. 14 lb. of indigo, how many pounds?

Ans. 1078.

52. In

52. In 547 great pounds, how many common pounds?

Ans. 820 com. lb. 8 oz.

53. Bought 27 bags of hops, each 2 cwt. 1 qr. 15 lb. and 1 bag of 137 lb. How many hundreds in the whole?

Ans. 65 cwt. 2 qrs. 10 lb.

54. How many pounds in 27 hogsheds of tobacco, each weighing neat 8 cwt. $\frac{3}{4}$?

Ans. 26460.

55. In 552 common pounds of silk, how many great pounds?

Ans. 368.

56. How many parcels of sugar of 16lb. 2 oz. are there in 26 cwt. 1 qr. 15 lb.?

Ans. 113 par. 12 lb. 14 oz.

The Allowances usually made in this Weight, are TARE, TRET, and CLOFF.

TARE is an allowance made to the buyer for the weight of the box, barrel, bag, &c. which contains the goods bought, and is either

At so much per box, bag, barrel, &c.

At so much per cent. or,

At so much in the gross weight.

TRET is an allowance of 4lb. in every 104lb. for waste, dust, &c. made by the merchant to the buyer.

CLOFF is an allowance of 2lb. to the citizens of London, on every draught above 3 cwt. on some sort of goods.

GROSS WEIGHT is the whole weight of any sort of goods, and that which contains it.

SUTTLE is when part of the allowance is deducted from the gross.

NEAT is the pure weight, when all allowances are deducted.

RULE 1st. When the tare is at so much per bag, barrel, &c. multiply the number of bags, barrels, &c. by the tare, and subtract the produce from the gross, the remainder is neat.

Note, To reduce pounds into gallons, multiply by 2, divide by 15.

57. In 7 frails of raisins, each weighing 5 cwt. 2 qrs. 5lb. gross, tare at 23 lb. per frail, how much neat weight?

Ans. 37 cwt. 1 qr. 14lb.

58. In

or thus :

23	5 .. 2 .. 5	5 .. 2 .. 5
7	7	—
<hr/> 4)	<hr/>	<hr/> 23
28(161(5	38 .. 3 .. 7 = <i>gross.</i>	5 .. 1 .. 10
140 1 .. 1	1 .. 1 .. 21 = <i>tare.</i>	7
<hr/>	<hr/>	<hr/>
21	37 .. 1 .. 14 <i>neat.</i>	37 .. 1 .. 14

58. In 241 barrels of figs, each 3 qrs. 19 lb. gros, tare 10 lb. per barrel, how many pounds neat? *Ans.* 22413.

59. What is the neat weight of 25 hogsheads of tobacco, weighing gross 163 cwt. 2 qrs. 15 lb. tare 100 lb. per hoghead?
Ans. 141 cwt. 1 qr. 7 lb.

60. In 16 bags of pepper, each 85 lb. 4 oz. grofs, tare per bag 3 lb. 5 oz. how many pounds neat? *Ans.* 1311.

RULE 2. When the tare is at so much in the whole gross weight, subtract the given tare from the gross, the remainder is neat.

61. What is the neat weight of 5 hogsheads of tobacco, weighing gross 75 cwt. 1 qr. 14 lb. tare in the whole 752 lb.?
Ans. 68 cwt. 2 qrs. 18 lb.

62. In 75 barrels of figs, each 2 qrs. 27 lb. gross, tare in the whole 597 lb. how much neat weight?
Ans. 50 cwt. 1 qr.

RULE 3. When the tare is at so much *per* cwt. divide the gross weight by the aliquot parts of an cwt. which subtract from the gross, the remainder is neat.

Note. 7 lb. is $\frac{1}{16}$. 8 lb. is $\frac{1}{14}$. 14 lb. is $\frac{1}{8}$. 16 lb. $\frac{1}{7}$.

63. What is the neat weight of 18 butts of currants, each 8 cwt. 2 qrs. 5 lb. tare at 14 lb. *per* cwt.?

$$\begin{array}{r} 8 \dots 2 \dots 5 \\ 9 \times 2 = 18 \\ \hline 76 \dots 3 \dots 17 \\ 2 \end{array}$$

$$\begin{array}{r} 14 = \frac{1}{8}) 153 \dots 3 \dots 6 \\ \underline{19 \dots 0 \dots 25 \frac{1}{4}} \\ 134 \dots 2 \dots 8 \frac{1}{4} \end{array}$$

64. In 25 barrels of figs, each 2 cwt. 1 qr. gross, tare *per cent.* 16 lb. how much neat weight?

Ans. 48 cwt. 0 qr. 24 lb.

65. What is the neat weight of 9 hogsheads of nutmegs, each weighing gross 8 cwt. 3 qrs. 14 lb. tare 16 lb. *per cent.*?

Ans. 68 cwt. 1 qr. 24 lb.

66. What is the neat weight of 12 casks of argol, gross 84 cwt. 2 qrs. 14 lb. tare *per cent.* 14 lb.?

Ans. 74 cwt. 0 qr. 5 lb. $\frac{1}{4}$.

RULE 4. When trett is allowed with tare, divide the pounds futtle by 26, the quotient is the trett, which subtract from the futtle, the remainder is neat.

67. In one butt of currants, weighing 12 cwt. 2 qrs. 24 lb. gross, tare 14 lb. *per cent.* trett 4 lb. *per* 104 lb. how many pounds neat?

$$\begin{array}{r}
 12 \text{ .. } 2 \text{ .. } 24 \\
 4 \\
 \hline
 50 \\
 28 \\
 \hline
 14 = \frac{1}{8} \quad 1424 \text{ gross} \\
 \quad \quad 178 \text{ tare} \\
 \hline
 26 \overline{) 1246} \text{ futtle} \\
 \quad \quad 47 \text{ trett} \\
 \hline
 1199 \text{ neat.}
 \end{array}$$

68. In 7 cwt. 3 qrs. 27 lb. gross, tare 36 lb. trett 4 lb. *per* 104 lb. how many pound neat? *Ans.* 826 lb.

69. In 152 cwt. 1 qr. 3 lb. gross, tare 10 lb. *per cent.* trett 4 lb. *per* 104 lb. how much neat weight?

Ans. 133 cwt. 1 qr. 11 lb.

70. In 15 chests of sugar, weighing 117 cwt. 0 qr. 21 lb. gross, tare 173 lb. trett 4 lb. *per* 104 lb. how many cwt. neat?

Ans. 111 cwt. 0 qr. 22 lb.

RULE 5. When cloff is allowed, multiply the cwt. futtle by 2, divide the product by 3, the quotient will be the pounds cloff, which subtract from the futtle, the remainder will be neat.

71. What

71. What is the neat weight of 3 hogsheads of tobacco, weighing 15 cwt. 3 qrs. 20 lb. gross, tare 7 lb. per cent. trett 4 lb. per 104 lb. cloff 2 lb. for 3 cwt?

Ans. 14. cwt. 1 qr. 3 lb..

$$7 = \frac{1}{16} \quad 15 \quad .. \quad 3 \quad .. \quad 20 \quad \text{gross.}$$

$$3 \quad .. \quad 27\frac{1}{2} \quad \text{tare.}$$

$$14 \quad .. \quad 3 \quad .. \quad 20\frac{1}{2} \quad \text{futile.}$$

$$2 \quad .. \quad 8 \quad \text{trett.}$$

$$14 \quad .. \quad 1 \quad .. \quad 12\frac{1}{2} \quad \text{futile.}$$

$$9\frac{1}{2} \quad \text{cloff.}$$

$$14 \quad .. \quad 1 \quad .. \quad 3 \quad \text{neat.}$$

72. In 7 hogsheads of tobacco, each weighing gross 5 cwt. 2 qrs. 7 lb. tare 8 lb. per cent. trett 4 lb. per 104 lb. cloff 2 lb. per 3 cwt. how much neat weight?

Ans. 34 cwt. 2 qrs. 8 lb.

APOTHECARIES WEIGHT.

73. 27 lb. 7 $\frac{3}{4}$. 2 3 . 1 \emptyset . 2 gr. how many grains?

Ans. 159022.

74. How many lb $\frac{3}{4}$. 3 . \emptyset . and gr. are there in 159022 grains?

Ans. 27 lb. 7 $\frac{3}{4}$. 2 3 . 1 \emptyset 2 gr..

CLOTH MEASURE.

75. In 27 yards, how many nails? *Ans.* 432.

76. In 75 English ells, how many yards?

Ans. 93 yards, 3 qrs.

77. In 93 $\frac{3}{4}$ yards, how many English ells? *Ans.* 75.

78. In 24 pieces, each containing 32 Flemish ells, how many English ells?

Ans. 460 ells, 4 qrs.

79. In 17 pieces of cloth, each 27 Flemish ells, how many yards?

Ans. 344 yards, 1 qr.

80. Bought 27 pieces of English stuffs, each 27 ells, how many yards?

Ans. 911 yards, 1 qr.

81. In 911 $\frac{1}{4}$ yards, how many English ells? *Ans.* 729.

82. In 12 bales of cloth, each 25 pieces, each 15 English ells, how many yards?

Ans. 5625.

L O N G M E A S U R E.

83. In 57 miles, how many furlongs and poles?

Ans. 456 furlongs, 18240 poles.

84. In 7 miles, how many feet, inches, and barley-corns?

Ans. 36960 feet, 443520 inches, 1330560 barley-corns.

85. In 18240 poles, how many furlongs and miles?

Ans. 456 furlongs, 57 miles.

86. In 72 leagues, how many yards? *Ans.* 380160.

87. In 380160 yards, how many miles and leagues?

Ans. 216 miles, 72 leagues.

88. If from London to York be accounted 50 leagues, I demand how many miles, yards, feet, inches, and barley-corns?

Ans. 150 miles, 264000 yards, 792000 feet, 9504000 inches, 28512000 barley-corns.

89. How many barley corns will reach round the world, which is 360 degrees, each degree 69 miles and an half?

Ans. 4755801600 barley-corns.

L A N D M E A S U R E.

90. In 27 acres, how many roods and perches?

Ans. 108 roods, 4320 perches.

91. In 4320 perches, how many acres? *Ans.* 27.

92. A person having a piece of ground, containing 37 acres, 1 pole, has a mind to dispose of 15 acres to A, I desire to know how many perches he will have left?

Ans. 3521.

93. There are 4 fields to be divided into shares of 75 perches each; the first field containing 5 acres; the second 4 acres, 2 poles; the third, 7 acres, 3 roods; and the fourth, 2 acres 1 rood; I desire to know how many shares are contained therein?

Ans. 40 shares, 42 perches.

W I N E M E A S U R E.

94. Bought 5 tun of port wine, how many gallons and pints?

Ans. 1260 gallons, 10080 pints.

95. In 10080 pints, how many tuns? *Ans.* 5.

96. In 5896 gallons of Canary, how many pipes and hogf-heads, and of each a like number?

Ans. 31 of each, 37 gallons over.

97. A

97. A gentleman ordered his butler to bottle off $\frac{2}{3}$ of a pipe of French wine into quarts, and the rest into pints; I desire to know how many dozen of each he had?

Ans. 28 dozen of each.

ALE and BEER MEASURE.

98. In 46 barrels of beer, how many pints? *Ans.* 13248.

99. In 10 barrels of ale, how many gallons and quarts?

Ans. 320 gals. 1280 qts.

100. In 72 hogheads of beer, how many barrels?

Ans. 108 barrels.

101. In 108 barrels of beer, how many hogheads?

Ans. 72.

DRY MEASURE.

102. In 120 quarters of wheat, how many bushels, pecks, gallons, and quarts?

Ans. 960 bushels, 3840 pecks, 7680 gallons, 30720 qts..

103. In 30720 quarts of corn, how many quarters?

Ans. 120.

104. In 20 chaldron of coals, how many pecks?

Ans. 2880.

105. In 273 lasts of corn, how many pecks?

Ans. 87360..

T I M E.

106. In 72015 hours, how many weeks?

Ans. 428 weeks, 4 days, 15 hours..

107. How many days is it since the birth of our Saviour to Christmas 1755?

Ans. 641013 days, 18 hours.

108. Stowe writes, London was built 1108 years before our Saviour's birth, how many hours is it since to Christmas, 1775?

Ans. 25097058 hours.

109. From November 17, 1738, to September 12, 1739, how many days?

Ans. 299.

110. From July 18, 1749, to December 27, in the same year, how many days?

Ans. 162 days.

111. From July 18, 1723, to April 18, 1750, how many years and days?

Ans. 26 years, 9770 days, reckoning 365 days, 6 hours a year..

The SINGLE RULE of THREE DIRECT

TEACHETH, by three numbers given, to find out a fourth, in such proportion to the third, as the second is to the first.

RULE. First state the question, that is, place the numbers in such order, that the first and third be of one kind, and the second the same as the number required; then bring the first and third numbers into one name, and the second into the lowest term mentioned. Multiply the second and third numbers together, and divide the product by the first, the quotient will be the answer to the question in the same denomination you left the second number in.

E X A M P L E S.

1. If 1 lb. of sugar cost 4d. $\frac{1}{2}$, what cost 54 lb.?

$$\begin{array}{r} 1 \dots 4\frac{1}{2} \dots 54 \\ 4 \dots 18 \\ \hline 18 \ 4 \overline{) 972} \\ \hline 12 \overline{) 243} \end{array}$$

Ans. 1 .. - .. 3.

20 s. 3d.

2. If a gallon of ale cost 3d. what is that *per* barrel?

Ans. 9s.

3. If a pair of shoes cost 4s. 6d. what will 12 dozen come to?

Ans. £32..8..-.

4. If 12 dozen pair of stockings cost £32..8..-. what is that *per* pair?

Ans. 4s. 6d.

5. If 1 yard of cloth cost 15s. 6d. what will 32 yards cost at the same rate?

Ans. £24..16..-.

6. If 32 yards of cloth cost £24..16..-. what is the value of 1 yard?

Ans. 15s. 6d.

7. If 1 lb. of sugar cost 10d. $\frac{1}{2}$, what is the worth of 1 cwt.?

Ans. £4..18..-.

8. If I gave £4..18..-. for 1 cwt. of sugar, at what rate did I buy it at *per* lb.?

Ans. 10d. $\frac{1}{2}$.

9. If I buy 20 pieces of cloth, each 20 ells, for 12s. 6d. *per* ell, what is the value of the whole?

Ans. £250.

10. Bought 20 pieces of Holland, each 20 ells, for £250. what is that *per* ell?

Ans. 12s. 6d.

11. What

ASSISTANT. *Single Rule of Three Direct.* 43

11. What will 25 cwt. 3 qrs. 14 lb. of tobacco come to, at 15d. $\frac{1}{2}$ per lb. *Ans. £ 187..3..3.*

12. I gave £187..3..3 for 25 cwt. 3 qrs. 14 lb. of tobacco, at what rate did I buy it at per lb. *Ans. 15d. $\frac{1}{2}$.*

13. Bought 27 yds. $\frac{1}{4}$ muslin, at 6s. 9d. $\frac{1}{2}$ per yard, what does it amount to? *Ans. £ 9..5.. $\frac{3}{4}$. 2 rem.*

14. Bought 17 cwt. 1 qr. 14 lb. of iron, at 3d. $\frac{1}{4}$ per lb. what does it come to? *Ans. £ 26..7.. $\frac{1}{2}$.*

15. If coffee is sold for 5d. $\frac{1}{2}$ per ounce, what must be given for 2 cwt.? *Ans. £ 82..2..8.*

16. How many yards of cloth may be bought for £21..11.. 1 $\frac{1}{2}$. when 3 yards $\frac{1}{2}$ cost £ 2..14..3? *Ans. 27 yds. 3 qrs. 1 nail, 42 rem.*

17. If 3 lb. $\frac{1}{2}$, of Cheshire cheese cost 1s. 1d. what cost 1 cwt.? *Ans. £1..14..8.*

18. If 1 cwt. of Cheshire cheese cost £1..14.. 8. what must I give for 3 lb. *Ans. 1s. 1d.*

19. Bought 1 cwt. 24 lb. 8 oz. of old lead, at 9s. per cwt. what does it come to? *Ans. 10s. 11d. $\frac{1}{2}$ 112 rem.*

20. If 1 cwt. 24 lb. 8 oz. of lead be worth 10s. 11d. $\frac{1}{2}$. $\frac{1}{2}$ $\frac{1}{2}$ what is that per cwt. *Ans. 9s.*

21. If a gentleman's income is £500 a year, and he spends 19s. 4d. per day, how much does he lay by at the year's end? *Ans. £147..3..4.*

22. If I buy 14 yards of cloth for 10 guineas, how many Flemish ells can I buy for £ 283..17..6. at the same rate. *Ans. 504 Fl. ells, 2 qrs.*

23. If £283..17..6. will buy 504 Flemish ells, 2 quarters, what quantity of yards can I have for £10..10..-.? *Ans. 14 yds.*

24. If 504 Flemish ells, 2 quarters, cost £283..17..6, at what rate must I give for 14 yards. *Ans. £ 10..10..-.*

25. Gave £1..1..8. for 3 lb. of coffee, what must be given for 29 lb. 4 oz. *Ans. £10..11..3.*

26. Bought 29 lb. 4 oz. of coffee, for £10..11..3. what is the value of 3 lb.? *Ans. £1..1..8.*

27. If 1 oz. $\frac{1}{2}$ of coffee cost 6d. $\frac{1}{4}$, what will 3 oz. $\frac{1}{4}$ cost at the same rate? *Ans. 1s. 1d. $\frac{1}{2}$. 1 rem.*

28. If one English ell, 2 quarters, cost 4s. 7d. what will 39 yards $\frac{1}{2}$ cost at the same rate? *Ans. £5..3..5 $\frac{1}{4}$.*

29. If one ounce of gold is worth £5..4..2. what is the worth of 1 grain? *Ans. 2d. $\frac{1}{2}$. 20 rem.*

30. If

44 *Single Rule of Three Direct. The Tutor's*

30. If 14 yards of broad cloth cost £9..12..-. what is the purchase of 75 yards? *Ans. £51..8..6 $\frac{1}{4}$. 6 rem.*

31. If 27 yards of holland cost £5..12..6. how many ells English can I buy for £100.? *Ans. 384.*

32. If 1cwt. cost £12..12..6. what must I give for 14 cwt. 1 qr. 19lb.? *Ans. £182..-..11 $\frac{1}{2}$. 8 rem.*

33. Bought 7 yards of cloth for 17s. 8d. what must be given for 5 pieces, each containing 27 yards $\frac{1}{2}$? *Ans. £17..7..- $\frac{1}{4}$. 2 rem.*

34. If 7 oz. 11 dwt. of gold be worth £35. what is the value of 14 lb. 9 oz. 12 dwt. 16 gr. at the same rate? *Ans. £823..9..3 $\frac{3}{4}$. 552 rem.*

35. A draper bought 420 yards of broad cloth, at the rate of 14s. 10d. $\frac{3}{4}$ per ell English, how much did he pay for the whole? *Ans. £250..5..-.*

36. A gentleman bought a wedge of gold, which weighed 14 lb. 3 oz. 8 dwt. for the sum of £514..4..-. at what rate did he pay for it per ounce? *Ans. £3.*

37. A grocer bought 4 hogsheds of sugar, each weighing neat 6 cwt. 2 qrs. 14 lb. which cost him £2..8..6. per cwt. what is the value of the 4 hogsheds? *Ans. £64..5..3.*

38. A draper bought 8 packs of cloth, each containing 4 parcels, each parcel 10 pieces, and each piece 26 yards, and gave after the rate of £4..16..-. for 6 yards, I desire to know what the 8 packs stood him in? *Ans. £6656.*

39. If 24 lb. of raisins cost 6s. 6d. what will 18 fraills cost, each weighing neat 3 qrs. 18 lb.? *Ans. £24..17..3.*

40. If 1 ounce of silver be worth 5s. what is the price of 14 ingots, each weighing 7 lb. 5 oz. 10 dwt.? *Ans. £313..5.*

41. What is the price of a pack of wool weighing 2 cwt. 1 qr. 19 lb. at 8s. 6d. per stone? *Ans. £8..4..6 $\frac{1}{4}$. 10 rem.*

42. Bought 59 cwt. 2 qrs. 24 lb. of tobacco, at £2..17..4. per cwt. what does it come to? *Ans. £171..3..7 $\frac{1}{4}$ 80 rem.*

43. What is the half year's rent of 547 acres of land, at 15s. 6d. per acre per annum? *Ans. £211..19..3.*

44. Bought 171 ton of lead, at £14. per ton; paid carriage and other incident charges, £4..10..-. I require the value of the lead, and what it stands me in per lb.? *Ans. £2398..10..-. value 1d. $\frac{1}{2}$, 432 rem. per lb.*

45. If a pair of stockings cost 10 groats, how many dozen may I buy for £43..5..-? *Ans. £21 doz. 7 pair $\frac{1}{2}$.*

46. Bought

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46. Bought 27 dozen, 5 lb. of candles, after the rate of 17d. per 3 lb. What did they cost me?

Ans. £ 7..15..4 $\frac{1}{4}$. 1 rem.

47. If an ounce of fine gold is sold for £3..10..-. what comes 7 ingots to, each weighing 3 lb. 7 oz. 14 dwt. 21 gr. at the same price?

Ans. £ 1071..14..5 $\frac{1}{4}$

48. If my horse stands me in 9d. $\frac{1}{2}$ per day keeping, what will be the charge of 11 horses for the year?

Ans. £ 158..18..6 $\frac{1}{2}$.

49. A factor bought 86 pieces of stuff, which cost him £517..19..4. at 4s. 10d. per yard, I demand how many yards there were, and how many ells English in a piece?

Ans. 2143 yards $\frac{1}{4}$, 14 rem. and 19 ells, 4 quarters, 2 nails, 64 rem. in a piece.

50. A gentleman hath an annuity of £896..17..- per annum. I desire to know how much he may spend daily, that at the year's end he may lay up 200 guineas, and give to the poor quarterly 10 moidores? *Ans.* £ 1..14..8. 44 rem.

The RULE of THREE INVERSE.

INVERSE PROPORTION is, when more requires less and less requires more. More requires less, is when the third term is greater than the first, and requires the fourth term to be less than the second. And less requires more, is when the third term is less than the first, and requires the fourth term to be greater than the second.

RULE. Multiply the first and second terms together, and divide the product by the third, the quotient will bear such proportion to the second as the first does to the third.

EXAMPLES.

1. If 8 men can do a piece of work in 12 days, how many days can 16 men perform the same in? *Ans.* 6 days.

$$8 : 12 :: 16 :: 6$$

8

16)96(6 days.

2. If 54 men can build a house in 90 days, how many men can do the same in 50 days? *Ans.* 97 men $\frac{1}{5}$.

3. If

46 *The Rule of Three Inverse.* *The TUTOR'S*

3. If, when a peck of wheat is sold for 2s. the panny loaf weighs 8 oz. how much will it weigh when the peck is worth but 1s. 6d.

Ans. 10 oz. 10 dr. $\frac{3}{4}$.

4. How many pieces of money of 20s. value are equal to 240 pieces of 12s. each?

Ans. 144.

5. How many yards of three quarters wide are equal in measure to 30 yards of 5 quarters wide?

Ans. 50.

6. If I lend my friend £200. for 12 months, how long ought he to lend me £150 to requite my kindness?

Ans. 16 months.

7. If for 24s. I have 1200 lb. carried 36 miles, how many pounds can I have carried 24 miles for the same money?

Ans. 1800 lb.

8. If 108 workmen finish a piece of work in 12 days, how many are sufficient to finish it in 3 days?

Ans. 432.

9. An army besieging a town, in which were 1000 soldiers, with provisions for three months, how many soldiers departed, when the provisions lasted them 6 months?

Ans. 500.

10. If £20. worth of wine is sufficient to serve an ordinary of 100 men, when the tun is sold for £30. how many will £20. worth suffice, when the tun is sold but for £24.?

Ans. 125 men.

11. A courier makes a journey in 24 days, when the day is but 12 hours long, how many days will he be going the same journey, when the days are 16 hours long?

Ans. 18 days.

12. How much plush is sufficient for a cloak, which has in it 4 yards of 7 quarters wide of stuff for the lining, the plush being but 3 quarters wide?

Ans. 9 yards $\frac{1}{3}$.

13. If 14 pioneers make a trench in 18 days, how many days will 34 take to do the same?

Ans. 7 days, 4 hours, 56 minutes, 16 rem.

14. Borrowed of my friend £64. for 8 months, and he hath occasion another time to borrow of me for 12 months, how much must I lend him to requite his former kindness to me?

Ans. £42..13..4.

15. A regiment of soldiers, consisting of 1000 men, are to have new coats, each coat to contain 2 yards $\frac{1}{2}$ of cloth, 5 quarters wide, and to be lined with shalloon of 3 quarters wide: I demand how many yards of shalloon will line them?

Ans. 4166 yards, 2 quarters, 2 nails, 2 rem.

The

The DOUBLE RULE of THREE

IS so called, because it is composed of 5 numbers given to find a sixth, which, if the proportion is direct, must bear such proportion to the 4th and 5th, as the 3d bears to the 1st and 2d. But if inverse, the 6th number must bear such proportion to the 4th and 5th, as the 1st bears to the 2d and 3d. The three first terms are a supposition; the two last, a demand.

RULE 1. Let the principal cause of loss or gain, interest or decrease, action or passion, be put in the first place.

2. Let that which betokeneth time, distance of place, and the like, be in the second place, and the remaining one in the third.

3. Place the other two terms under their like, in the supposition.

4. If the blank falls under the third term, multiply the first and second terms for a divisor, and the other three for a dividend. But,

5. If the blank falls under the first or second term, multiply the third and fourth terms for a divisor, and the other three for the dividend, and the quotient will be the answer.

PROOF. By two single rules of three.

EXAMPLES.

1. If 14 horses eat 56 bushels of oats in 16 days, how many bushels will be sufficient for 20 horses for 24 days?

<i>By two single rules.</i>				} <i>or in one stating, worked thus,</i>	
<i>hor.</i>	<i>bu.</i>	<i>hor.</i>	<i>bu.</i>		<i>hor. days. bu.</i>
1. As 14 :	56 :	20 :	80	14 : 16 :	56
days.	bu.	days.	bu.	20 : 24 :	—
				$\frac{56 \times 20 \times 24}{14 \times 16} = 120$	
2. As 16 :	80 :	24 :	120		

2. If 8 men in 14 days can mow 112 acres of grass. How many men must there be to mow 2000 acres in 10 days?

<i>acres. days. acres. days.</i>				} <i>men. days. acres.</i>	
<i>days. men.</i>	<i>days. men.</i>				<i>men. days. acres.</i>
1. As 112 :	14 :	2000 :	250	8 : 14 :	112
days.	men.	days.	men.	— : 10 :	2000
				$\frac{8 \times 14 \times 2000}{112 \times 10} = 200$	
2. As 250 :	8 :	10 :	200		

3. If

3. If £100. in 12 months gain £6. interest, how much will £75. gain in 9 months? *Ans.* £3..7..6.

4. If a carrier receives £2..2..-. for the carriage of 3 cwt. 150 miles, how much ought he to receive for the carriage of 7 cwt. 3 qrs. 14 lb. for 50 miles? *Ans.* £1..16..9.

5. If a regiment of soldiers, consisting of 136 men, consume 351 quarters of wheat in 108 days, how many quarters of wheat will 11232 soldiers consume in 56 days?

Ans. 15031.

6. If 40 acres of grass be mowed by 8 men in 7 days, how many acres can be mowed by 24 men in 28 days?

Ans. 480.

7. If 40s. will pay 8 men for 5 days work, how much will pay 32 men for 24 days work? *Ans.* £38..8..-.

8. If £100. in 12 months gain £6. interest, what principal will gain £3..7..6. in 9 months? *Ans.* £75.

9. If a regiment, consisting of 939 soldiers, consume 351 quarters of wheat in 168 days, how many soldiers will consume 1404 quarters in 56 days? *Ans.* 11268.

10. In a family consisting of 7 persons, there are drank out 2 kilderkins of beer in 12 days, how many kilderkins will there be drank out by another family of 14 persons in 8 days?

Ans. 2 kil. 12 gal.

11. If the carriage of 60 cwt. 20 miles cost £14..10..-. what weight can I have carried 30 miles for £5..8..9. at the same rate of carriage? *Ans.* 15 cwt.

12. If 2 horses eat 8 bushels of oats in 16 days, how many horses will eat up 3000 quarters in 24 days?

Ans. 4000.

13. If £100 in 12 months gain £7. interest, what is the interest of £571 for 6 years? *Ans.* £239..16..4 $\frac{3}{4}$.

14. If I pay 10s. for the carriage of 2 tons, 6 miles, what must I pay for the carriage of 12 tons, 17 cwt. 17 miles?

Ans. £9..2..- $\frac{1}{2}$.

P R A C T I C E

IS so called, from the general use thereof by all persons concerned in trade and business.

All questions in this rule are performed by taking aliquot or even parts, by which means many tedious reductions are avoided; the table of which is as follows:

Of

Of a Pound.	Of a Shilling.	Of a Ton.	Of an Hundred.
s. d.	d.	cwt.	qrs. lb.
10 .. - is - $\frac{1}{2}$	6 is .. - - $\frac{1}{2}$	10 - is - - $\frac{1}{2}$	2 or 56 - is $\frac{1}{2}$
6 .. 8 - - $\frac{1}{4}$	4 - - - - $\frac{1}{4}$	5 - - - - $\frac{1}{4}$	1 or 28 - - $\frac{1}{4}$
5 .. - - - $\frac{1}{4}$	3 - - - - $\frac{1}{4}$	4 - - - - $\frac{1}{8}$	14 - - - $\frac{1}{8}$
4 .. - - - $\frac{1}{8}$	2 - - - - $\frac{1}{8}$	2 $\frac{1}{2}$ - - - $\frac{1}{8}$	Of a Quarter.
3 .. 4 - - $\frac{1}{8}$	1 $\frac{1}{2}$ - - - $\frac{1}{8}$	2 - - - - $\frac{1}{10}$	14 - - - - $\frac{1}{4}$
2 .. 6 - - $\frac{1}{8}$	1 - - - - $\frac{1}{12}$		7 - - - - $\frac{1}{4}$
2 .. - - - $\frac{1}{10}$			4 - - - - $\frac{1}{8}$
1 .. 8 - $\frac{1}{12}$			3 $\frac{1}{2}$ - - - $\frac{1}{8}$

RULE 1. When the price is less than a penny, divide by the aliquot parts that are in a penny; then by 12 and 20, it will be the answer.

$\frac{1}{4}$ is $\frac{1}{4}$ 5704 lb. at $\frac{1}{4}$	7695 at $\frac{1}{2}$	6547 at $\frac{3}{4}$
12) 1426	Facit £16..-..7 $\frac{1}{2}$	Facit £20..9..2 $\frac{3}{4}$
2) 0) 1118..10	5740 at $\frac{1}{2}$	4573 at $\frac{3}{4}$
£ 5..18..10	Facit £11..19..2	Facit £14..5..9 $\frac{3}{4}$

RULE 2. When the price is less than a shilling, take the aliquot part or parts that are in a shilling, add them together and divide by 20, as before.

1 is $\frac{1}{12}$ 7547 at 1d.	6254 at 1d $\frac{1}{4}$	7062 at 3d $\frac{1}{4}$
2) 0) 62) 8..11	Facit 45..12..- $\frac{1}{2}$	Facit £95..12..7 $\frac{1}{2}$
£31..8..11	2351 at 2d.	2147 at 3d $\frac{1}{2}$
	Facit £19..11..10	Facit £31..6..2 $\frac{1}{2}$
1 is $\frac{1}{12}$ 3751 at 1d $\frac{1}{4}$	7210 at 2d $\frac{1}{4}$	7000 at 3d $\frac{3}{4}$
is $\frac{1}{4}$) 312..7	Facit £67..11..10 $\frac{1}{2}$	Facit 109..7..6
78..1 $\frac{3}{4}$	2710 at 2d $\frac{1}{2}$	3257 at 4d.
2) 0) 39) 0..8 $\frac{3}{4}$	Facit £28..4..7	Facit £54..5..8
£19..10..8 $\frac{3}{4}$	3250 at 2d $\frac{3}{4}$	2056 at 4d $\frac{1}{4}$
	Facit £37..4..9 $\frac{1}{2}$	Facit £36..8..2
54325 at 1d $\frac{1}{2}$	2715 at 3d.	3752 at 4d $\frac{1}{2}$
Facit £339..10..7 $\frac{1}{2}$	Facit £33..18..9	Facit £70..7..-

50 Practice.

$$\begin{array}{r} 2107 \text{ at } 4d. \frac{3}{4} \\ \text{Facit } \pounds 41..14..-\frac{1}{4} \end{array}$$

$$\begin{array}{r} 3210 \text{ at } 5d. \\ \text{Facit } \pounds 66..17..6 \end{array}$$

$$\begin{array}{r} 2715 \text{ at } 5d. \frac{1}{4} \\ \text{Facit } 59..7..9\frac{3}{4} \end{array}$$

$$\begin{array}{r} 3120 \text{ at } 5d. \frac{1}{2} \\ \text{Facit } \pounds 71..10..- \end{array}$$

$$\begin{array}{r} 7521 \text{ at } 5d. \frac{3}{4} \\ \text{Facit } \pounds 180..3..9\frac{3}{4} \end{array}$$

$$\begin{array}{r} 3271 \text{ at } 6d. \\ \text{Facit } \pounds 81..15..6 \end{array}$$

$$\begin{array}{r} 7914 \text{ at } 6d. \frac{1}{4} \\ \text{Facit } \pounds 206..1..10\frac{1}{2} \end{array}$$

$$\begin{array}{r} 3250 \text{ at } 6d. \frac{1}{2} \\ \text{Facit } \pounds 88..-..5 \end{array}$$

$$\begin{array}{r} 2708 \text{ at } 6d. \frac{3}{4} \\ \text{Facit } \pounds 76..3..3 \end{array}$$

$$\begin{array}{r} 3271 \text{ at } 7d. \\ \text{Facit } \pounds 95..8..1 \end{array}$$

$$\begin{array}{r} 3254 \text{ at } 7d. \frac{1}{4} \\ \text{Facit } \pounds 98..5..11\frac{1}{2} \end{array}$$

$$\begin{array}{r} 2701 \text{ at } 7d. \frac{1}{2} \\ \text{Facit } \pounds 84..8..1\frac{1}{2} \end{array}$$

$$\begin{array}{r} 3714 \text{ at } 7d. \frac{3}{4} \\ \text{Facit } 119..18..7\frac{1}{2} \end{array}$$

$$\begin{array}{r} 2710 \text{ at } 8d. \\ \text{Facit } \pounds 90..6..8 \end{array}$$

$$\begin{array}{r} 3514 \text{ at } 8d. \frac{1}{4} \\ \text{Facit } \pounds 120..15..10\frac{1}{2} \end{array}$$

$$\begin{array}{r} 2759 \text{ at } 8d. \frac{1}{2} \\ \text{Facit } \pounds 97..14..3\frac{1}{2} \end{array}$$

$$\begin{array}{r} 9872 \text{ at } 8d. \frac{3}{4} \\ \text{Facit } \pounds 359..18..4 \end{array}$$

$$\begin{array}{r} 5272 \text{ at } 9d. \\ \text{Facit } \pounds 197..14..- \end{array}$$

$$\begin{array}{r} 6325 \text{ at } 9d. \frac{1}{4} \\ \text{Facit } \pounds 243..15..6\frac{1}{4} \end{array}$$

$$\begin{array}{r} 7924 \text{ at } 9d. \frac{1}{2} \\ \text{Facit } \pounds 313..13..2 \end{array}$$

The TUTOR'S

$$\begin{array}{r} 2150 \text{ at } 9d. \frac{3}{4} \\ \text{Facit } \pounds 87..6..10\frac{1}{2} \end{array}$$

$$\begin{array}{r} 6325 \text{ at } 10d. \\ \text{Facit } \pounds 263..10..10 \end{array}$$

$$\begin{array}{r} 5724 \text{ at } 10d. \frac{1}{4} \\ \text{Facit } \pounds 244..9..3 \end{array}$$

$$\begin{array}{r} 6327 \text{ at } 10d. \frac{1}{4} \\ \text{Facit } \pounds 270..4..3\frac{3}{4} \end{array}$$

$$\begin{array}{r} 3254 \text{ at } 10d. \frac{1}{2} \\ \text{Facit } \pounds 142..7..3 \end{array}$$

$$\begin{array}{r} 7291 \text{ at } 10d. \frac{3}{4} \\ \text{Facit } \pounds 326..11..6\frac{1}{4} \end{array}$$

$$\begin{array}{r} 3256 \text{ at } 11d. \\ \text{Facit } \pounds 149..4..8 \end{array}$$

$$\begin{array}{r} 7254 \text{ at } 11d. \frac{1}{4} \\ \text{Facit } \pounds 340..-..7\frac{1}{2} \end{array}$$

$$\begin{array}{r} 3754 \text{ at } 11d. \frac{1}{2} \\ \text{Facit } \pounds 179..17..7 \end{array}$$

$$\begin{array}{r} 7972 \text{ at } 11d. \frac{3}{4} \\ \text{Facit } \pounds 390..5..11 \end{array}$$

RULE 3. When the price is more than one shilling, and less than two, take the part or parts, with so much of the given price as is more than a shilling, which add to the given quantity, and divide by 20, it will give the answer.

$$\begin{array}{r} \frac{1}{4} \frac{1}{4} \frac{1}{8} 2106 \text{ at } 12d. \frac{1}{4} \\ 43..10\frac{1}{2} \end{array}$$

$$\begin{array}{r} 210) 21419..10\frac{1}{2} \\ \pounds 107..9..10\frac{1}{2} \end{array}$$

$$\begin{array}{r} \frac{1}{2} \frac{1}{2} \frac{1}{4} 3715 \text{ at } 12d. \frac{1}{2} \\ 154..9\frac{1}{2} \end{array}$$

$$\begin{array}{r} 210) 38619..9\frac{1}{2} \\ \pounds 193..9..9\frac{1}{2} \end{array}$$

$$\begin{array}{r} 2712 \text{ at } 12d. \frac{3}{4} \\ \text{Facit } \pounds 144..1..6 \end{array}$$

$$\begin{array}{r} 2107 \text{ at } 1s. 1d. \\ \text{Facit } \pounds 114..2..7 \end{array}$$

ASSISTANT.

3215 at 1s. 1d. $\frac{1}{4}$
Facit £177..9..10 $\frac{3}{4}$

2790 at 1s. 1d. $\frac{1}{2}$
Facit £156..18..9

7904 at 1s. 1d. $\frac{3}{4}$
Facit £452..16..8

3750 at 1s. 2d.
Facit £218..15..-

3291 at 1s. 2d. $\frac{1}{4}$
Facit £195..8..- $\frac{1}{4}$

9254 at 1s. 2d. $\frac{1}{2}$
Facit £559..1..11

7250 at 1s. 2d. $\frac{3}{4}$
Facit £445..11..5 $\frac{1}{2}$

7591 at 1s. 3d.
Facit £474..8..9

6325 at 1s. 3d. $\frac{1}{4}$
Facit £401..18..- $\frac{1}{4}$

5271 at 1s. 3d. $\frac{1}{2}$
Facit £340..8..4 $\frac{1}{2}$

3254 at 1s. 3d. $\frac{3}{4}$
Facit £213..10..10 $\frac{1}{2}$

2915 £ at 1s. 4d.
Facit £194..6..8

3270 at 1s. 4d. $\frac{1}{4}$
Facit £221..8..1 $\frac{1}{2}$

7059 at 1s. 4d. $\frac{1}{2}$
Facit £485..6..1 $\frac{1}{2}$

2750 at 1s. 4d. $\frac{3}{4}$
Facit £191..18..6 $\frac{1}{2}$

3725 at 1s. 5d.
Facit £263..17..1

7250 at 1s. 5d. $\frac{1}{4}$
Facit £521..1..10 $\frac{1}{2}$

2597 at 1s. 5d. $\frac{1}{2}$
Facit £189..7..3 $\frac{1}{2}$

7210 at 1s. 5d. $\frac{3}{4}$
Facit £533..4..9 $\frac{1}{2}$

7524 at 1s. 6d.
Facit £564..6..-

7103 at 1s. 6d. $\frac{1}{4}$
Facit £540..2..5 $\frac{3}{4}$

3254 at 1s. 6d. $\frac{1}{2}$
Facit £250..16..7

7925 at 1s. 6d. $\frac{3}{4}$
Facit £619..2..9 $\frac{3}{4}$

9271 at 1s. 7d.
Facit £733..19..1

7210 at 1s. 7d. $\frac{1}{4}$
Facit £578..6..- $\frac{1}{2}$

2310 at 1s. 7d. $\frac{1}{2}$
Facit £187..13..9

2504 at 1s. 7d. $\frac{3}{4}$
Facit £206..1..2

7152 at 1s. 8d.
Facit £596..-..-

2905 at 1s. 8d. $\frac{1}{4}$
Facit £245..2..2 $\frac{1}{4}$

7104 at 1s. 8d. $\frac{1}{2}$
Facit £606..16..-

Practice. 51

1004 at 1s. 8d. $\frac{3}{4}$
Facit £86..16..1

2104 at 1s. 9d.
Facit £184..2..-

2571 at 1s. 9d. $\frac{1}{4}$
Facit £227..12..9 $\frac{3}{4}$

2104 at 1s. 9d. $\frac{1}{2}$
Facit £188..9..8

7506 at 1s. 9d. $\frac{3}{4}$
Facit £680..4..7 $\frac{1}{2}$

1071 at 1s. 10d.
Facit £98..3..6

5200 at 1s. 10d. $\frac{1}{4}$
Facit £482..1..8

2117 at 1s. 10d. $\frac{1}{2}$
Facit £198..9..4 $\frac{1}{2}$

1007 at 1s. 10d. $\frac{3}{4}$
Facit £95..9..1 $\frac{1}{4}$

5000 at 1s. 11d.
Facit £479..3..4

2105 at 1s. 11d. $\frac{1}{4}$
Facit £203..18..5 $\frac{1}{4}$

1006 at 1s. 11d. $\frac{1}{2}$
Facit £98..10..1

2705 at 1s. 11d. $\frac{3}{4}$
Facit £267..13..7 $\frac{1}{4}$

5000 at 1s. 11d. $\frac{1}{2}$
Facit £489..11..8

4000 at 1s. 11d. $\frac{3}{4}$
Facit £395..16..8

RULE 4. When the price consists of any even number of shillings under 20, multiply the given quantity by half the price, doubling the first figure of the product for shillings, and the rest of the product will be pounds.

2750 at 2s. Facit £275..-.-	2102 at 10s. Facit £1051..-.-	1075 at 16s. Facit £860...-.-
3254 at 4s. Facit £650..16.-	2101 at 12s. Facit £1260..12.-	1621 at 18s. Facit £1458..18.-
2710 at 6s. Facit £813..-.-	5271 at 14s. Facit £3689..14.-	Note, When the price is 10s. take half of the quantity, and if any remains, it is 10s.
1572 at 8s. Facit £628..16.-	3123 at 16s. Facit £2498..8.-	

RULE 5. When the price consists of odd shillings, multiply the given quantity by the price, and divide by 20, the product will be the answer.

2703 at 1s. Facit £135..3.-	2715 at 7s. Facit £950..5.-	2150 at 15s. Facit £1612..10.-
3270 at 3s. 3.	3214 at 9s. Facit £1446..6.-	3142 at 17s. Facit £2670..14.-
2109810	2710 at 11s. Facit £1490..10.-	2150 at 19s. Facit £2042..10.-
490..10.-	3179 at 13s. Facit £2066..7.-	7157 at 19s. Facit £6799..3.-
3271 at 5s. Facit £817..15.-	Note, When the price is 5s. divide the quantity by 4, and if any remains it is 5s.	

RULE 6. When the price is shillings and pence, and they the aliquot part of a pound, divide by the aliquot part, and it will give the answer at once; but if they are not an aliquot part, then multiply the quantity by the shillings, and take parts for the rest, add them together and divide by 20.

s. d.			
6..8	$\frac{1}{3}$	2710 at 6s. 8d. Facit £903..6..8	
		3150 at 3s. 4d. Facit £525..--..	
		2715 at 2s. 6d. Facit £339..7..6	
		7150 at 1s. 8d. Facit £595..16..8	
		3215 at 1s. 4d. Facit £214..6..8	
		7211 at 1s. 3d. Facit £450..13..9	
d.			
2	$\frac{1}{6}$	2710 at 3s. 2d. 3	
		8130	
		451..8	
	210	858|1..8	
		£429..1..8	
		7514 at 4s. 7d. Facit £1721..19..2	

2517 at 5s. 3d. Facit £660..14..3
2547 at 7s. 3d. $\frac{1}{2}$ Facit £928.11.10 $\frac{1}{2}$
3271 at 5s. 9d. $\frac{1}{4}$ Facit £943.16.4 $\frac{1}{4}$
2103 at 15s. 4d. $\frac{1}{2}$ Facit £1616.13.7 $\frac{1}{2}$
7152 at 17s. 6d. $\frac{3}{4}$ Facit £6280..7..-
2510 at 14s. 7d. $\frac{1}{4}$ Facit £1832.16.5 $\frac{1}{2}$
3715 at 9s. 4d. $\frac{1}{2}$ Facit £1741.8.1 $\frac{1}{2}$
2572 at 13s. 7d. $\frac{1}{2}$ Facit £1752..3..6
7251 at 14s. 8d. $\frac{1}{4}$ Facit £5324.19.- $\frac{1}{4}$
3210 at 15s. 7d. $\frac{3}{4}$ Facit £2511.3.1 $\frac{1}{2}$
2710 at 19s. 2d. $\frac{1}{2}$ Facit £2602.14.7

RULE 7. 1st. When the price is pounds and shillings, multiply the quantity by the pounds, and proceed with the shillings, if they are even, as in the 4th rule; if odd, take the aliquot parts, add them together, the sum will be the answer.

2^{dly}. When pounds, shillings and pence, and the shillings and pence the aliquot parts of a pound, multiply the quantity by the pounds, and take parts for the rest.

3^{dly}. When the price is pounds, shillings, pence, and farthings, and the shillings and pence not the aliquot parts

of a pound, reduce the pounds and shillings into shillings, multiply the quantity by the shillings, take parts for the rest, add them together, and divide by 20.

Note, *When the given quantity is no more than three figures, proceed as in Compound Multiplication.*

4	$\frac{1}{3}$	7215 at £ 7..4..-	2107 at £ 1..13..-
		7	Facit £ 3476..11..-
		50505	3215 at £ 4..6..8
		1443	Facit £ 13931.13.4
s. d. z..6	$\frac{1}{8}$	51948£.	2154 at £ 7..1..3
		2104 at £ 5..3..-	Facit £ 15212.12.6
		5	2701 at £ 2..3..4
		10520	Facit £ 5852..3..4-
6	$\frac{1}{5}$	263	2715 at £ 1..17..2 $\frac{1}{2}$
		52 .. 12	Facit £ 5051..-.7 $\frac{1}{2}$
		10835 .. 12	2157 at £ 3..15..2 $\frac{1}{4}$
		2107 at £ 2..8..-	Facit £ 8108.19.5 $\frac{1}{4}$
		Facit £ 5056..16..-	3210 at £ 1..18..6 $\frac{3}{4}$
		7156 at £ 5..6..-	Facit £ 6189..5..7 $\frac{1}{2}$
		Facit £ 37926.16.-	2157 at £ 2..7..4 $\frac{1}{2}$
		2710 at £ 2..3..7 $\frac{1}{2}$	Facit £ 5109.7.10 $\frac{1}{2}$
6	$\frac{1}{2}$	43	142 at £ 1..15..2 $\frac{3}{4}$
		116530	Facit £ 250..2..6 $\frac{1}{2}$
		1355	95 at £ 15..14..7 $\frac{1}{4}$
		338 .. 9	Facit £ 1494..7..4 $\frac{1}{4}$
1 $\frac{1}{2}$	$\frac{1}{4}$	210	37 at £ 1..19..5 $\frac{3}{4}$
		1182213 .. 9	Facit £ 73..-.8 $\frac{3}{4}$
		£ 5911..3..9	2175 at £ 2..15..4 $\frac{1}{2}$
		3215 at £ 1..17..-	Facit £ 6022..-.7 $\frac{1}{2}$
		Facit £ 5947..15..-	2150 at £ 17.16.1 $\frac{1}{2}$
			Facit £ 38283..8..9

RULE 8. When the price and quantity given are of several denominations, multiply the price by the integers, and take part with the parts of the integers for the rest.

At £3..17..6.. *per* cwt. what is the value of 25 cwt. 2 qrs. 14lb. of tobacco?

<i>qrs.</i>				
2	$\frac{1}{2}$	£3 .. 17 .. 6		$5 \times 5 = 25$
		5		
		<hr/>		
		19.. 7 .. 6		
		5		
		<hr/>		
<i>lb.</i>		96 .. 17 .. 6		
14	$\frac{1}{4}$	1 .. 18 .. 9		
		9 .. $8\frac{1}{4}$		
		<hr/>		
		99 .. 5.. $11\frac{1}{4}$		

2. At £1..4..9 *per* cwt. what comes 17 cwt. 1 qr. 17lb. of cheese to? *Ans.* £21..10..8.

3. Sold 85 cwt. 1 qr. 10 lb. of cheese, at £1..7..8 *per* cwt. what does it come to? *Ans.* £118..1.. $\frac{1}{2}$.

4. Hops at £4..5..8 *per* cwt. what must be given for 72 cwt. 1 qr. 18 lb.? *Ans.* £310..3..2.

5. At £1..1..4 *per* cwt. what is the value of 27 cwt. 2 qrs. 15 lb. of Malaga raisins? *Ans.* 29..9.. $6\frac{1}{4}$.

6. Bought 78 cwt. 3 qrs. 12lb. of currants, at £2..17..9 *per* cwt. what did I give for the whole? *Ans.* £227..14..-

7. Sold 56 cwt. 1 qr. 17 lb. of sugar, at £2..15..9 the cwt. what does it come to? *Ans.* £157..4.. $4\frac{1}{2}$.

8. Tobacco at £3..17..10 the cwt. what is the worth of 97 cwt. 15 lb.? *Ans.* £378..-..3.

9. At £4..14..6 the cwt. what is the value of 37 cwt. 2 qrs. 13 lb. of double refined sugar? *Ans.* £177..14.. $8\frac{1}{2}$.

10. Bought sugar at £3..14..6 the cwt. what did I give for 15 cwt. 1 qr. 10 lb.? *Ans.* £57..2..9.

11. At £4..15..4 the cwt. the value of 172 cwt. 3 qrs. 12 lb. of tobacco is required? *Ans.* £823..19.. $\frac{1}{4}$.

12. Soap at £3..11..6 the cwt. what is the value of 53 cwt. 17 lb.? *Ans.* £190..-..4.

INTEREST.

I N T E R E S T.

INTEREST is either SIMPLE or COMPOUND.

S I M P L E I N T E R E S T

IS the PROFIT allowed in lending or forbearance of any sum of money, for a determined space of time.

The PRINCIPAL is the money lent, for which Interest is to be received.

The RATE PER CENT. is a certain sum agreed on between the Borrower and the Lender, to be paid for every £100. for the use of the Principal for 12 months.

The AMOUNT is the Principal and Interest added together.

INTEREST is also applied to Commission, Brokage, Purchasing of Stocks, and Insurance.

*To find the Interest of any Sum of Money for a Year.*RULE. Multiply the Principal by the Rate *per Cent.* that product, divided by 100, will give the Interest required.*For several years.*

Multiply the Interest of one year by the number of years given in the question, and the product will be the answer.

EXAMPLES.

1. What is the interest of £375 for a year, at 5
- per cent. per annum*
- ?

$$\begin{array}{r} 5 \\ 18 \overline{) 75} \\ 20 \end{array}$$

15 | 00 *Ans. £18..15..-*

2. What is the interest of £268 for one year, at 4
- per cent. per annum*
- ?

Ans. £10..14..4 $\frac{1}{2}$.

3. What is the interest of £945..10..- for a year, at 4
- per cent. per annum*
- ?

Ans. £37..16..4 $\frac{1}{2}$.

4. What is the interest of £547..15..- at 5
- per cent. per annum*
- , for 3 years?

Ans. £82..3..3.

5. What

5. What is the interest of £254..17..6 for 5 years, at 4 per cent. per annum? *Ans.* £50..19..6.

6. What is the interest of £556..13..4 at 5 per cent. per annum, for 5 years? *Ans.* £139..3..4.

COMMISSION

Is an allowance from merchants to their factors or correspondents, in the buying or selling of goods, and is generally at a certain Rate per Cent. according to the custom of the country where the factor resides.

RULE. Multiply the Principal by the Rate per Cent. as before; and for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, take the part or parts from the Principal, which added to the product, and divided by 100, will give the answer.

7. What is the commission of £287..10..—, at $3\frac{1}{2}$ per cent.

$$\frac{1}{2}, \frac{1}{2}, 287..10$$

3

Ans. £10..1..3.

$$862..10 = 3$$

$$143..15 = \frac{1}{2}$$

$$10106..5 = 3\frac{1}{2}$$

20

1125

13

3100

8. What must I allow my correspondent for disbursing on my account £529..18..5, at $2\frac{1}{4}$ per cent.

Ans. £11..18..5 $\frac{1}{2}$.

9. My correspondent writes me word, that he has bought goods to the amount of £754..16..—, on my account, what does his commission come to at $2\frac{1}{2}$ per cent?

Ans. £18..17..4 $\frac{3}{4}$.

10. If I allow my factor $3\frac{3}{4}$ per cent. for commission, what may he demand on the laying out £876..5..10?

Ans. £32..17..2 $\frac{1}{2}$.

PURCHASING of STOCKS.

RULE. Multiply the sum to be purchased by the excess, above 100; divide that product by 100, the produce of which, added to the given sum, is the purchase required.

If

If under Par, (that is under £100.) multiply by the Rate per Cent. that product, divided by 100, gives the purchase thereof.

11. What is the purchase of £575..10..-. Bank Stock, at $131\frac{3}{4}$ per cent.?

$$6 \times 5 + 1 = 31$$

$$575..10$$

$$6$$

$$3453$$

$$5$$

$$17265..--- = 30$$

$$575..10..- = 1$$

$$287..15..- = \frac{1}{2} \frac{1}{4}$$

$$143..17..6 = \frac{1}{4}$$

$$182|72.. 2..6 = 31\frac{3}{4}$$

$$20$$

$$14|42$$

$$12$$

$$5|10$$

$$575..10..-$$

$$182..14..5$$

£ 753.. 4..5 *Answer.*

12. What is the purchase of £254..17..-. Bank Annuities, at $97\frac{1}{4}$ per cent.?

$$12 \times 8 + 1 = 97$$

$$254..17$$

$$12$$

$$3058.. 4$$

$$8$$

$$24465..12..- = 96$$

$$254..17..- = 1$$

$$63..14..3 = \frac{1}{4}$$

$$247|84.. 3..3 = 97\frac{1}{4}$$

$$20$$

$$16|83$$

$$12$$

$$9|99$$

$$4$$

$$3|96$$

£ 247..16..9 $\frac{3}{4}$ *Answer.*

13. At $110\frac{1}{4}$ per cent. what is the purchase of £2054..16..-. South-sea Stock? *Ans.* £2265..8..4.

14. At $104\frac{3}{8}$ per cent. South-sea Annuities, what is the purchase of £1797..14..-.? *Ans.* £1876..6..11 $\frac{3}{4}$.

15. What is the purchase of £2750..17..-. South-sea Old Annuities, at $102\frac{5}{8}$ per cent.? *Ans.* £2823..1..2 $\frac{1}{4}$.

16. At $96\frac{3}{4}$ per cent. what is the purchase of £577..19..-. Bank Annuities? *Ans.* 559..3..3 $\frac{3}{4}$.

17. At $124\frac{5}{8}$ per cent. what is the purchase of £758..17..10. India Stock? *Ans.* 945..15..4 $\frac{1}{4}$.

BROKAGE

B R O K A G E

Is an allowance to brokers, for helping merchants or factors to persons to buy or sell them goods.

RULE. Divide the sum given by 100, and take parts from the quotient with the Rate per Cent.

18. If I employ a broker to sell goods for me, to the value of £2375..17..6. what is the brokage, at 4s. per cent.?

$$\begin{array}{r}
 25 \overline{) 75..17..6} \\
 \underline{20} \\
 15 \overline{) 17} \\
 \underline{12} \\
 2 \overline{) 10}
 \end{array}
 \quad
 \begin{array}{r}
 4s. \frac{1}{5} \quad 25..15..2 \\
 \hline
 \text{Ans. } £5..3..-\frac{1}{4}
 \end{array}$$

19. What is the brokage of £796..14..7. at 6s. per cent.?

Ans. £2..7..9 $\frac{1}{2}$.

20. When a broker sells goods to the amount of £7105..5..10, what may he demand for brokage, if he is allowed 5s. 6d. per cent.?

Ans. £19..10..9 $\frac{1}{4}$.

21. If a broker is employed to buy a quantity of goods, to the value of £975..6..4. what is the brokage, at 6s. 6d. per cent.?

Ans. £3..3..4 $\frac{1}{2}$.

When the time is $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a year, besides a number of years given,

RULE. Take parts of the interest for one year, which add to the interest of the several years given, and it will give the answer.

22. What is the interest of £554..10..- for 3 months at 4 per cent. per annum?

$$\begin{array}{r}
 554..10 \\
 \underline{4} \\
 22 \overline{) 18..-} \\
 \underline{20} \\
 3 \overline{) 60} \\
 \underline{12} \\
 m. \quad 7 \overline{) 20} \\
 3 \frac{1}{4} \quad 22..3..7 \\
 \hline
 \text{Ans. } 5..10..10\frac{3}{4}
 \end{array}$$

23. What is the interest of £336..15..6. for 2 years $\frac{1}{4}$, at 5 per cent. per annum?

$$\begin{array}{r}
 336..15..6 \\
 \underline{5} \\
 16 \overline{) 83..17..6} \\
 \underline{20} \\
 16 \overline{) 77} \\
 \underline{12} \\
 9 \overline{) 30} \quad \frac{1}{2} \quad \frac{1}{2} \\
 \underline{4} \quad \frac{1}{4} \quad \frac{1}{2} \\
 1 \overline{) 20}
 \end{array}
 \quad
 \begin{array}{r}
 16..16..9\frac{1}{4} \\
 \underline{2} \\
 33..13..6\frac{1}{2} \\
 8..8..4\frac{1}{2} \\
 \underline{4..4..2\frac{1}{4}} \\
 \text{Ans. } 46..6..1\frac{1}{4}
 \end{array}$$

24. What

24. What is the interest of £325..7..6. at 6 *per cent. per annum*, for 3 years and a half? *Ans.* £68..6..6 $\frac{1}{4}$.

25. What is the interest of £547..2..4. for 5 years and a half, at 4 *per cent. per annum*? *Ans.* £120..7..3 $\frac{1}{4}$.

26. What is the interest of £257..5..1. at 4 *per cent.* for a year and three quarters? *Ans.* £18..-..1 $\frac{1}{2}$.

27. What is the interest of £479..5..- for 5 years 1 quarter, at 5 *per cent. per annum*? *Ans.* £125..16- $\frac{3}{4}$.

When the Rate *per Cent.* is $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, *more than the pounds given in the rate*, proceed as in commission, and it will give the answer for one year; and, for several, proceed as in the last rule.

28. What is the interest of £175..17..- for two years and 3 quarters, at 4 $\frac{1}{2}$ *per cent. per annum*?

$$\begin{array}{r}
 \frac{1}{2} \frac{1}{2} \quad 175..17 \\
 \underline{\quad 4 \quad} \\
 703..8..- \\
 87..18..6 \\
 \underline{\quad} \\
 7191..6..6 \\
 20 \\
 \underline{\quad} \\
 18126 \\
 12 \\
 \underline{\quad} \\
 3118
 \end{array}$$

$$\begin{array}{r}
 \frac{3}{2} \frac{1}{2} \quad 7..18..3 \\
 \underline{\quad 2 \quad} \\
 15..16..6 \\
 \frac{3}{4} \frac{1}{2} \quad 3..19..1\frac{1}{2} \\
 \underline{\quad 1..19..6\frac{3}{4} \quad} \\
 \pounds 21..15..2\frac{1}{4} \text{ Ans.}
 \end{array}$$

29. What is the interest of £397..9..5. for two years and 1 quarter, at 3 $\frac{1}{2}$ *per cent. per annum*? *Ans.* £31..6..-.

30. What is the interest of £576..2..7, for 7 years and 1 quarter, at 4 $\frac{1}{2}$ *per cent. per annum*? *Ans.* £187..19..1 $\frac{1}{2}$.

31. What is the interest of £279..13..8. at 5 $\frac{1}{4}$ *per cent. per annum*, for 3 years and a half? *Ans.* £51..7..10.

When the interest is required for any number of weeks,

RULE. As 52 weeks are to the interest of the given sum for a year; so are the weeks given, to the interest required.

32. What

32. What is the interest of £379..13..2 for four weeks, at 4 per cent. per annum?

av. £. s. d. av.
As 52 .. 15 .. 3 .. $8\frac{1}{2} :: 4 :$

20
—
303
12
—
3644
4
—
14578
4
—
4)
52)58312(1121
52 —
— 12)280 $\frac{1}{4}$
63 —
52 2|0)2|3..4 $\frac{1}{4}$
—
111 1..3..4 $\frac{1}{4}$
104
—
72
52
—
20

379..13..2
4
—
15|18..12..8
20
—
3|72
12
—
8|72
4
—
2|88

Or thus: multiply by the number of weeks, and divide the product by 4 and 13, being $4 \times 13 = 52$ 13)15..3..8 $\frac{1}{2}$.

N. B. As it is 4 weeks, I don't multiply, but only divide by 13.

33. What is the interest of £259..13..5. for 20 weeks, at 5 per cent. per annum? *Ans.* £4..19..10 $\frac{1}{4}$.

34. What is the amount of £375..6..1. for 12 weeks, at 4 $\frac{1}{2}$ per cent. per annum? *Ans.* £379..4..0 $\frac{1}{4}$.

35. What is the amount of £256..5..3. for 25 weeks, at 2 $\frac{1}{4}$ per cent. per annum? *Ans.* £259..13..—.

When the Interest is for any number of days,

RULE. Multiply the pence of the principal by the days and rate per cent. for a dividend, cut off two figures on the right-hand, and divide by 365, the quotient will be the answer in pence. Or,

As 365 days, are to the interest of the given sum for a year: so are the days given, to the interest required,

G

36. What

62 Interest.

The TUTOR'S

36. What is the interest of £240. for 120 days, at 4 per cent. per annum?

$$\begin{array}{r}
 240 \\
 240 \\
 \hline
 57600 \\
 120 \\
 \hline
 6912000 \\
 4 \\
 \hline
 12 \\
 365)276480|00(757 \\
 2555 \quad \hline
 210)6|3..1 \\
 2098 \quad \hline
 1825 \quad \text{£}3..3..1\frac{1}{4} \\
 \hline
 2730 \\
 2555 \\
 \hline
 175 \\
 4 \\
 \hline
 1700(1 \\
 365 \\
 \hline
 335
 \end{array}$$

Or thus,

$$\begin{array}{r}
 240 \text{ As } 365 : 9..12 :: 120 \\
 4 \quad \quad 20 \\
 \hline
 9|60 \quad 192 \\
 20 \quad 120 \\
 \hline
 12|00 \quad 365)23040(6|3 \\
 2190 \quad \hline
 \text{£}3..3..1\frac{1}{4} \\
 1140 \\
 1095 \\
 \hline
 45 \\
 12 \\
 \hline
 1540(1 \\
 365 \\
 \hline
 175 \\
 4 \\
 \hline
 1700(1 \\
 365 \\
 \hline
 335
 \end{array}$$

37. What is the interest of £379..5..4. for three years and 75 days, at 5 per cent. per annum? *Ans.* £ 60..15..8.

38. At £5½ per cent. per annum, what is the interest of £985..2..7. for 5 years, 127 days? *Ans.* £289..15..3.

39. What is the interest of £2726..1..4. at 4d.½ per cent. per annum, for 3 years, 154 days. *Ans.* £419..15..6¼.

When the amount, time, and rate per cent. are given, to find the principal.

RULE. As the amount of £100. at the rate and time given: is to £100 :: so is the amount given: to the principal required.

40. What

40. What principal being put to interest will amount to £402..10..- in 5 years, at 3 per cent. per annum?

$$\begin{array}{r} 3 \times 5 + 100 = \text{£}115 : 100 : : 402..10 \\ \quad \quad \quad \underline{20} \quad \quad \quad \underline{20} \\ \quad \quad \quad 2300 \quad \quad \quad 8050 \\ \quad \quad \quad \quad \quad \quad 100 \end{array}$$

 $23|00)8050|00(\text{£}350. \text{Ans.}$

41. What principal being put to interest for 9 years will amount to £734..8..-, at 4 per cent. per annum? *Ans.* £540.

42. What principal being put to interest for 7 years, at 5 per cent. per annum, will amount to £334..16..-? *Ans.* £248.

When the principal, rate per cent. and amount are given, to find the time.

RULE. As the interest of the principal for 1 year : is to 1 year :: so is the whole interest to the time required.

43. In what time will £350. amount to £402..10..- at 3 per cent. per annum?

350	As 10..10 : 1 : : 52..10 : 5			
3	20	20		
10|50	210	210	105|0	(5 years Ans. 402..10
20			105	350.. -
10|00			. . .	52..10

44. In what time will £540. amount to £734..8.-. at 4 per cent. per annum? *Ans. 9 years.*

45. In what time will £248. amount to £334..16..- at 5 per cent. per annum? *Ans.* 7 years.

When the principal, amount, and time are given, to find the rate per cent.

RULE. As the principal : is to the interest for the whole time : : so is £100 : to the interest for the same time. Divide that interest by the time, and the quotient will be the rate *per cent*.

46. At what rate *per cent.* will £350. amount to £402..10..- in 5 years time?

$$\begin{array}{r} 350 \\ \hline 52..10..- \end{array} \quad \text{As } 350 : 52..10 :: 100 : £15.$$

$$\begin{array}{r} 20 \\ \hline 1050 \\ \hline 100 \end{array}$$

$$350 | 10500 | 0 (300s. £15 \div 5 = 3 \text{ per cent.}$$

47. At what rate *per cent.* will £248. amount to £334..16..- in 7 years time? *Ans.* 5 per cent.

48. At what rate *per cent.* will £540. amount to £734..8..- in 9 years time? *Ans.* 4 per cent.

Compound INTEREST

Is that which arises both from the principal and interest; that is, when the interest on money becomes due, and not paid, the same interest is allowed on that interest unpaid, as was on the principal before.

RULE 1. Find the first year's interest, which add to the principal: then find the interest of that sum, which add as before, and so on for a number of years.

2. Subtract the given sum from the last amount, and it will give the compound interest required.

EXAMPLES.

1. What is the compound interest of £500. forborne 3 years, at 5 per cent. *per annum*?

$$\begin{array}{r} 500 \quad 500 \\ 5 \quad 25 \\ \hline \end{array} \quad \begin{array}{r} 525 \\ 26..5 \\ \hline \end{array}$$

$$25 | 00 \quad 525 \text{ 1st year.} \quad 551..5 \text{ 2d year.}$$

$$\begin{array}{r} 5 \\ \hline 26 | 25 \\ 20 \\ \hline 5 | 00 \end{array} \quad \begin{array}{r} 5 \\ \hline 27 | 56..5 \\ 20 \\ \hline 11 | 25 \\ 12 \\ \hline 3 | 00 \end{array}$$

$$\begin{array}{r} 551..5 \\ 27..11..3 \\ \hline \end{array}$$

$$\begin{array}{r} 578..16..3 \text{ 3d year.} \\ 500 \text{ prin. sub.} \\ \hline \end{array}$$

$$\begin{array}{r} 78..16..3 = \text{interest} \\ \text{for 3 years.} \end{array}$$

2. What is the amount of £400. forborne $3\frac{1}{2}$ years, at 6 per cent. *per annum*, compound interest? *Ans.* £490..13..11 $\frac{1}{4}$.

3. What

3. What will £650. amount to in 5 years, at 5 per cent. per annum, compound interest? *Ans.* £829..11..7½.

4. What is the amount of £550..10..-. for 3 years and 6 months, at 6 per cent. per annum, compound interest?

Ans. £675..6..5.

5. What is the compound interest of £764. for 4 years and 9 months, at 6 per cent. per annum? *Ans.* £243..18..8½.

6. What is the compound interest of £57..10..6. for 5 years, 7 months, and 15 days, at 4½ per cent. per annum?

Ans. £18..3..8¼.

7. What is the compound interest of £259..10..-. for 3 years, 9 months, and 10 days, at 4½ per cent. per annum?

Ans. £46..19..9.

REBATE or DISCOUNT

IS the abating so much money on a debt, to be received before it is due, as that money, if put to interest, would gain in the same time, and at the same rate. As £100. present money would discharge a debt of £105. to be paid a year to come, rebate being made at 5 per cent.

RULE. As £100. with the interest for the time given : is to that interest : : so is the sum given : to the rebate required.

Subtract the rebate from the given sum, and the remainder will be the present worth.

EXAMPLES.

1. What is the discount and present worth of £487..12. for 6 months, at 6 per cent. per annum?

6m. ½6

As 103 : 3 :: 487..12

—

20

20

3

—

—

100

2060

9752

—

3

103

—

£. s.

206[0]2925[6](14..4 rebate.

206

487..12

14.. 4

—

—

865

Ans. 473..8..-. present worth. 824

416=4s.

G 3

2. What

2. What is the present payment of £357..10..-. which was agreed to be paid 9 months hence, at 5 per cent. per annum?

Ans. 344..11..7.

3. What is the discount of £275..10..-. for 7 months, at 5 per cent. per annum?

Ans. £7..16..1 $\frac{1}{4}$.

4. Bought goods to the value of £109..10..-. to be paid at 9 months, what present money will discharge the same, if I am allowed 6 per cent. per annum discount?

Ans. £104..15..8 $\frac{1}{2}$.

5. What is the present worth of £527..9..1. payable 7 months hence, at 4 $\frac{1}{2}$ per cent.?

Ans. £514..13..10 $\frac{3}{4}$.

6. What is the discount of £85..10..-. due September the 8th, this being July the 4th, rebate at 5 per cent. per annum?

Ans. 15s. 3d. $\frac{3}{4}$.

7. Sold goods for £875..5..6. to be paid 5 months hence, what is the present worth at 4 $\frac{1}{2}$ per cent.?

Ans. £859..3..4.

8. What is the present worth of £500. payable in 10 months, at 5 per cent. per annum?

Ans. £480.

9. How much ready money can I receive for a note of £75. due 15 months hence, at 5 per cent.?

Ans. £70..11..9 $\frac{1}{4}$.

10. What will be the present worth of £150. payable at 3 four months; i. e. one third at 4 months, one third at 8 months, and one third at 12 months, at 5 per cent. discount?

Ans. £145..3..9 $\frac{1}{4}$.

11. Sold goods to the value of £575..10..-. to be paid at two 3 months, what must be discounted for present payment, at 5 per cent.?

Ans. £10..11..4 $\frac{3}{4}$.

12. What is the present worth of £500. at 4 per cent. £100. being to be paid down, and the rest at two 6 months?

Ans. £488..7..9.

EQUATION OF PAYMENTS

IS when several sums are due at different times, to find a mean time for paying the whole debt: to do which, this is the common

RULE. Multiply each term by its time, and divide the sum of the products by the whole debt, the quotient is accounted the mean time.

EXAMPLES.

EXAMPLES.

1. A owes B £200. whereof £40 is to be paid at 3 months, £60 at 5 months, and £100 at 10 months; at what time may the whole debt be paid together, without prejudice to either?

$$\begin{array}{rcl} \text{£.} & & \text{m.} \\ 40 \times 3 & = & 120 \\ 60 \times 5 & = & 300 \\ 100 \times 10 & = & 1000 \end{array}$$

$$2|00)14|20$$

7 months, $\frac{2}{10}$

2. B. owes C £800. whereof £200 is to be paid at 3 months, £100 at 4 months, £300 at 5 months, and £200 at 6 months; but they agreeing to make but one payment of the whole, I demand what that time must be?

Ans. 4 months, 18 days.

3. I bought of K a quantity of goods to the value of £360. which was to have been paid as follows: £120 at 2 months, £200 at 4 months, and the rest at 5 months; but they afterwards agreed to have it paid at one mean time; the time is demanded.

Ans. 3 months, 13 days.

4. A merchant bought goods to the value of £500. to pay £100 at the end of 4 months, £150 at the end of 6 months, and £250 at the end of 12 months; but afterwards they agreed to discharge the debt at one payment; at what time was this payment made?

Ans. 8 months, 12 days.

5. H is indebted to L a certain sum, which is to be paid at 6 different payments, that is, $\frac{1}{2}$ at 2 months, $\frac{1}{3}$ at 3 months, $\frac{1}{6}$ at 4 months, $\frac{1}{12}$ at 5 months, $\frac{1}{24}$ at 6 months, and the rest at 7 months; but they agree that the whole shall be paid at one equated time, what is that time?

Ans. 4 months, one quarter.

6. A is indebted to B £120. whereof $\frac{1}{2}$ is to be paid at 3 months, $\frac{1}{4}$ at 6 months, and the rest at 9 months, what is the equated time of the whole payments?

Ans. 5 months, 7 days.

B A R T E R

IS the exchanging one commodity for another, and informs the traders so to proportion their goods, that neither may sustain loss.

RULE 1st. Find the value of that commodity whose quantity is given; then find what quantity of the other, at the rate proposed, you may have for the same money.

2^{dly}. When one has goods at a certain price, *ready money*, but in Bartering advances it to something more, find what the other ought to rate his goods at, in proportion to that advance, and then proceed as before.

E X A M P L E S.

1. What quantity of chocolate, at 4s. per lb. must be delivered in barter for 2 cwt. of tea, at 9s. per lb.?

2 cwt.

112

224

9

4|2016 the value of the tea.

504 lb. of chocolate.

2. A and B barter; A hath 20 cwt. of prunes, at 4d. per lb. ready money, but in barter will have 5d. per lb. and B hath hops worth 32s. per cwt. ready money; what ought B to rate his hops at in barter, and what quantity must be given for the 20 cwt. of prunes?

112 As 4 : 5 :: 32

20

5

s.

40

2240

4)160

12

5

cwt. qr. lb. 40 S.

48|0)1120|0(23..1..9 $\frac{10}{8}$ Ans.

96

160

144

16 = 1 qr. 9 lb. $\frac{10}{8}$

3. How

3. How much tea, at 9s. per lb. can I have in barter for 4 cwt. 2 qrs. of chocolate, at 4s. per lb.? *Ans. 2 cwt.*

4. Two merchants barter; A hath 20 cwt of cheese, at 21s. 6d. per cwt. B hath eight pieces of Irish cloth, at £3..14..- per piece; I desire to know who must receive the difference, and how much?

Ans. B must receive of A £8..2..-

5. A and B barter: A hath $3\frac{1}{2}$ lb of pepper at 13d. $\frac{1}{2}$ per lb. B hath ginger at 15d. $\frac{1}{4}$ per lb. how much ginger must he deliver in barter for the pepper? *Ans. 3 lb. 1 oz. $\frac{3}{8}$ l.*

6. How many dozen of candles, at 5s. 2d. per dozen, must be delivered in barter for 3 cwt. 2 qrs. 16 lb. of tallow, at 37s. 4d. per cwt.? *Ans. 26 doz. 3 lb.*

7. A hath 608 yards of cloth, worth 14s. per yard, for which B giveth him £125..12..- in ready money, and 85 cwt. 2 qrs. 24 lb. of bees-wax. The question is, what did B reckon his bees-wax at per cwt.? *Ans. £3..10..-*

8. A and B. barter; A hath 320 dozen of candles, at 4s. 6d. per dozen; for which B giveth him £30 in money, and the rest in cotton, at 8d. per lb. I desire to know how much cotton B gave A besides the money?

Ans. 11 cwt. 1 qr.

9. If B hath cotton, at 1s. 2d. per lb. how much must he give A for 114 lb. of tobacco, at 6d. per lb.?

Ans. 48 lb. $\frac{12}{13}$

10. C hath nutmegs worth 7s. 6d. per lb. ready money, but in barter will have 8s. per lb. and D hath leaf tobacco worth 9d. per lb. ready money, how much must D rate his tobacco at per lb. that his profit may be equivalent with C's?

Ans. 9d. $\frac{1}{2}$ $\frac{3}{8}$

PROFIT and LOSS

IS a rule that discovers what is got or lost in the buying or selling of goods, and instructs us to rise or fall the price, so as to gain or lose so much *per cent.* or otherwise.

The questions in this rule are performed by the Rule of Three.

EXAMPLES.

EXAMPLES.

1. If a yard of cloth is bought for 11s. and sold for 12s. 6d. what is the gain per cent?

As 11 : 1..6 :: 100

12 20

18 2000

18

12..6

11..-

11)36000

1..6

12)3272

2|0)27|2..8

Ans. 13..12..8 $\frac{8}{11}$

2. If 60 ells of holland cost £18. what must 1 ell be sold for to gain 8 per cent.?

As 100 : 18 :: 108

108

12 × 5 = 60

1|00)19|44

20

12)19..8..9 $\frac{1}{2}$

8|80

12

5)1..12..4 $\frac{1}{4}$

6..5 $\frac{3}{4}$

9|60

4

2|30

Ans. 6s. 5d. $\frac{3}{4}$

3. If 1 lb. of tobacco cost 16d. and is sold for 20d. what is the gain per cent.?

Ans. £25.

4. If a parcel of cloth be sold for £560. and at £12 per cent. gain, what was the prime cost?

Ans. £500.

5. If a yard of cloth is bought for 13s. 4d. and sold again for 16s. what is the gain per cent.?

Ans. £20.

6. If 112 lb. of iron cost 27s. 6d. what must 1 cwt. be sold for to gain 15 per cent.?

Ans. £1..11..7 $\frac{1}{2}$

7. If 375 yards of broad cloth be sold for £490. and 20 per cent. profit, what did it cost per yard?

Ans. £1..1..9 $\frac{1}{4}$

8. Sold 1 cwt. of hops for £6..15..- at the rate of 25 per cent. profit, what would have been the gain per cent. if I had sold them for £8 per cwt.

Ans. £48..2..11 $\frac{1}{2}$

9. If 90 ells of cambric cost £60. how must I sell it per yard to gain £18 per cent.?

Ans. 12s. 7d.

10. A plumber sold 10 fother of lead for £204..15..- (the fother being 19 cwt. $\frac{1}{2}$) and gained after the rate of £12..10..- per cent. what did it cost him per cwt.

Ans. 18s. 8d.

11. Bought 436 yards of cloth, at the rate of 8s. 6d. per yard, and sold it for 10s. 4d. per yard, what was the gain of the whole?

Ans. £39..19..4.

12. Paid £69 for one ton of steel, which is retailed at 6d. per lb. what is the profit or loss, by the sale of 14 tons?

Ans. £182 loss.

13. Bought

13. Bought 124 yards of linen for £32. how should the same be retailed *per* yard to gain £15. *per* cent. ?

Ans. 5s. 11d. $\frac{23}{114}$.

14. Bought 249 yards of cloth, at 3s. 4d. *per* yard, re-tailed the same at 4s. 2d. *per* yard, what is the profit in the whole, and how much *per* cent. ?

Ans. £10..7..6. profit, and 25. *per* cent.

F E L L O W S H I P

IS when two or more join their stock and trade together, so to determine each person's particular share of the gain or loss, in proportion to his principal in the joint stock.

By this rule a bankrupt's estate may be divided amongst his creditors ; as also legacies may be adjusted when there is a deficiency of assets or effects.

FELLOWSHIP is either *with* or *without* TIME.

FELLOWSHIP *without* TIME.

RULE. As the whole stock : is to the whole gain or loss : : so is each man's share in stock : to his share of the gain or loss.

PROOF. Add all the shares together, and the sum will be equal to the given gain or loss—but the surest way is, as the whole gain or loss : is to the whole stock : : so is each man's share of the gain or loss : to his share in stock.

E X A M P L E S.

1. Two merchants trade together ; A put into stock £20. and B £40. they gained £50. what is each person's share thereof ?

$$\begin{array}{rcl}
 & 20 + 40 = 60 & \\
 \text{As } 60 : 50 :: 20 & \text{As } 60 : 50 :: 40 & 33.. 6..8 \text{ B's share.} \\
 \quad 20 & \quad 40 & 16..13..4 \text{ A's.} \\
 \hline
 6|0)100|0 & 6|0)200|0 & \hline
 \text{£}16..13..4 & \text{£}33..6..8. & 50
 \end{array}$$

2. Three

2. Three merchants trade together, A, B, and C; A put in £20. B £30. and C £40. they gained £180. what is each man's part of the gain? *Ans.* A £40. B £60. C £80.

3. A, B, and C enter into partnership: A puts in £364. B £482. and C £500. and they gained £867. what is each man's share in proportion to his stock?

Ans. A £234..9.. $3\frac{1}{4}$ —rem. 70. B £310..9..5—rem. 248.
C £322..1.. $3\frac{1}{2}$ —rem. 1028.

4. Four merchants, B, C, D, and E, made a stock; B put in £227. C £349. D £115. and E £439. in trading they gained £428. I demand each merchant's share of the gain?

Ans. B £85..19.. $6\frac{3}{4}$.—690. C £132..3..9—120.
D £43..11.. $1\frac{3}{4}$.—250. E £166..5.. $6\frac{1}{4}$.—70.

5. Three persons, D, E, and F, join in company; D's stock was £750. E's 460. and F's £500. and at the end of 12 months they gained £684. what is each man's particular share of the gain? *Ans.* D £300. E £184. and F £200.

6. A merchant is indebted to B £275..14..-. to C £304..7..-. to D £152. and to E £104..6..-. but upon his decease, his estate is found to be worth but £675..15.. how must it be divided among his creditors?

Ans. B's £222..15..2.—6584. C's £245..18.. $1\frac{1}{2}$.—15750.
D's £122..16.. $2\frac{3}{4}$.—12227, and E's £84..5..5.—15620.

7. Four persons trading together in a joint stock, of which A has $\frac{1}{3}$, B $\frac{1}{4}$, C $\frac{1}{5}$ and D $\frac{1}{6}$, and at the end of 6 months they gain £100. what is each man's share of the said gain?

Ans. A £35..1..9.—48. B £26..6.. $3\frac{3}{4}$.36. C £21..1.. $\frac{1}{2}$.—120 and D £17..10.. $10\frac{1}{2}$.—24.

8. Two persons purchased an estate of £1700 *per annum* freehold for £27200. when money was at 6 *per cent.* interest, and 4*s.* per pound land-tax, whereof D paid £15000. and E the rest; some time after the interest of the money falling to 5 *per cent.* and 2*s.* per pound land-tax, they sell the said estate for 24 years purchase; I desire to know each person's share?

Ans. D £22500; E £18300.

9. D, E, and F, join their stocks in trade; the amount of their stock is £647. and are in proportion as 4, 6 and 8 are to one another, and the amount of this gain is equal to D's stock; what is each man's stock and gain?

D's stock, £143..15.. $6\frac{1}{2}$ $\frac{2}{3}$ gain, £31..19..—184036.

E's - - 215..13..4 47..18..6.—414080.

F's - - 287..1.. $1\frac{1}{4}$ $\frac{1}{3}$ 63..18..—506098.

10. D,

10. D, E, and F, join stocks in trade: the amount of their stocks was £100. D's gain £3. E's £5. and F's £8. what was each man's stock?

Ans. D's stock £18..15..-. E's £31..5..-. and F's £50.

FELLOWSHIP *with* TIME.

RULE. As the sum of the products of each man's money and time: is to the whole gain or loss :: so is each man's product: to his share of the gain or loss.

PROOF. As in Fellowship without Time.

EXAMPLES.

1. D and E enter into partnership; D puts in £40. for three months, and E £75. for four months, and they gained £70. What is each man's share of the gain?

Ans. D £20. E £50.

$$\begin{array}{rcl} 40 \times 3 = 120 & \text{As } 420 : 70 :: 120 & \text{As } 420 : 70 :: 300 \\ 75 \times 4 = 300 & \quad \quad \quad 120 & \quad \quad \quad 300 \\ \hline & 420 & 420 \end{array}$$

2. Three merchants join in company, D puts in stock £195..14..-. for 3 months, E 169..18..3. for 5 months, and F £59..14..10. for 11 months, they gained £364..18..-. What is each man's part of the gain?

Ans. D's £102..6..4—5008. E's £148..1..1½—482802. and F's £114..10..6¼—14707.

3. Three merchants join in company for 18 months, D put in £500. and at five months end took out £200; at 10 months end put in £300. and at the end of 14 months takes out £130. E puts in £400. and at the end of 3 months £270. more; at 9 months he takes out £140. but puts in £100. at the end of 12 months, and withdraws £99. at the end of 15 months. F puts in £900. and at 6 months took out £200; at the end of 11 months put in £500. but takes out that and £100. more at the end of 13 months. They gained £200. I desire to know each man's share of the gain?

Ans. £ D 50..7..6—21720. E £62..12..5¼—29859. and F £87..-..-¼—14167.

H

4. D.

4. D, E, and F, hold a piece of ground in common, for which they are to pay £36..10..6. D puts in 23 oxen 27 days; E 21 oxen 35 days; and F 16 oxen 23 days. What is each man to pay of the said rent?

Ans. D £13..3..1½—524. E £15..11..5—1688. and
F £7..15..11—1136.

A L L I G A T I O N.

ALLIGATION *is either* MEDIAL *or* ALTERNATE.

A L L I G A T I O N M E D I A L

IS when the price and quantities of several simples are given to be mixed, to find the mean price of that mixture.

RULE. As the whole composition : is to its total value : : so is any part of the composition : to its mean price.

PROOF. Find the value of the whole mixture at the mean rate, and if it agrees with the total value of the several quantities at their respective prices, the work is right.

E X A M P L E S.

1. A farmer mixed 20 bushels of wheat, at 5*s.* per bushel, and 36 bushels of rye, at 3*s.* per bushel, with 40 bushels of barley, at 2*s.* per bushel. I desire to know the worth of a bushel of this mixture.

$$20 \times 5 = 100$$

$$36 \times 3 = 108$$

$$40 \times 2 = 80$$

$$96 \qquad \qquad \qquad 288$$

$$\text{As } 96 : 288 :: 1 : 3$$

Ans. 3*s.*

2. A vintner mingles 15 gallons of Canary, at 8*s.* per gallon, with 20 gallons, at 7*s.* 4*d.* per gallon, 10 gallons of sherry, at 6*s.* 8*d.* per gallon, and 24 gallons of white wine, at 4*s.* per gallon. What is the worth of a gallon of this mixture?

Ans. 6*s.* 2*d.* ½. ⅔.

3. A grocer mingled 4 cwt. of sugar, at 56*s.* per cwt. 7 cwt. at 43*s.* per cwt. and 5 cwt. at 37*s.* per cwt. I demand the price of 2 cwt. of this mixture? *Ans.* £4..8..9.

4. A

4. A maltster mingles 30 quarters of brown malt, at 28s. per quarter, with 46 quarters of pale, at 30s. per quarter, and 24 quarters of high-dried ditto, at 25s. per quarter. What is the value of 8 bushels of this mixture?

Ans. £.1..8..2 $\frac{1}{4}$. $\frac{6}{16}$.

5. If I mix 27 bushels of wheat, at 5s. 6d. per bushel, with the same quantity of rye, at 4s. per bushel, and 14 bushels of barley, at 2s. 8d. per bushel, what is the worth of a bushel of this mixture?

Ans. 4s. 3d. $\frac{3}{4}$. $\frac{28}{64}$.

6. A grocer mingled 3 cwt. of sugar, at 56s. per cwt. 6 cwt. at £1..17..4. per cwt. and 3 cwt. at £3..14..8 per cwt. What is 1 cwt. of this mixture worth?

Ans. £2..11..4.

7. A mealman has flour of several sorts, and would mix 3 bushels at 3s. 5d. per bushel, 4 bushels at 5s. 6d. per bushel, and 5 bushels at 4s. 8d. per bushel. What is the worth of a bushel of this mixture?

Ans. 4s. 7d. $\frac{1}{2}$. $\frac{4}{12}$.

8. A vintner mixes 20 gallons of Port, at 5s. 4d. per gallon, with 12 gallons of white wine, at 5s. per gallon, 30 gallons of Lisbon, at 6s. per gallon, and 20 gallons of mountain, at 4s. 6d. per gallon. What is a gallon of this mixture worth?

Ans. 5s. 3d. $\frac{3}{4}$. $\frac{50}{12}$.

9. A farmer mingled 20 bushels of wheat, at 5s. per bushel, and 36 bushels of rye, at 3s. per bushel, with 40 bushels of barley, at 2s. per bushel. I desire to know the worth of a bushel of this mixture?

Ans. 3s.

10. A person mixing a quantity of oats, at 2s. 6d. per bushel, with the like quantity of beans, at 4s. 6d. per bushel, would be glad to know the price of one bushel of that mixture?

Ans. 3s. 6d.

11. A refiner having 12lb. of silver bullion, of 6 oz. fine, would melt it with 8 lb. of 7 oz. fine, and 10lb. of 8 oz. fine, required the fineness of 1lb. of that mixture?

Ans. 6 oz. 18 dwt. 16 gr.

12. If with 40 bushels of corn, at 4s. per bushel, there are mixed 10 bushels at 6s. per bushel, 30 bushels at 5s. per bushel, and 20 bushels at 3s. per bushel, what will 10 bushels of that mixture be worth?

Ans. £2..3..-

13. A tobacconist would mix 50 lb. of tobacco at 11d. per lb. with 30lb. at 14d. per lb. 25 lb. at 22d. per lb. and 37 lb. at 2s. per lb. What will 1lb. of this mixture be worth?

Ans. 16d. $\frac{3}{4}$. $\frac{118}{142}$.

ALLIGATION ALTERNATE

Is when the price of several things are given, to find such quantities of them to make a mixture, that may bear a price propounded.

In ordering the rates and given price, observe,

1. Place them one under the other, 18— 2
and the propounded price or mean 22 20— 6
rate at the left hand of them, thus 24— 4
28— 2

4. Link the several rates together by 2 and 2, always observing to join a greater and a less than the mean.

3. Against each extreme place the difference of the mean and its yoke-fellow.

When the prices of the several simples and the mean rate are given without any quantity, to find how much of each simple is required to compose the mixture.

RULE. Take the difference between each price and the mean rate, and set them alternately, they will be the answer required.

PROOF. By Alligation Medial.

EXAMPLES.

1. A vintner would mix four sorts of wines together, of 18d. 20d. 24d. and 28d. per quart, what quantity of each must he take to sell the mixture at 22d. per quart?

<i>Answer.</i>	<i>Proof.</i>	<i>Or thus.</i>	<i>Proof.</i>
18—	2 of 18d. = 36d.	18—	6 of 18d. = 108d.
20—	6 of 20d. = 120	20—	2 of 20d. = 40
22 24—	14 of 24d. = 96	22 24—	2 of 24d. = 48
28—	2 of 28d. = 56	28—	4 of 28d. = 112
—	—	—	—
14	)308	14	)308
	22d.		22d.

Note. Questions in this rule admit of a great variety of answers, according to the manner of linking them.

2. A grocer would mix sugar at 4s. 6d. and 10d. per lb. so as to sell the compound for 8d. per lb. What quantity of each must he take? *Ans.* 2lb. at 4d. 2lb. at 6d. and 6lb. at 10d.

3. I desire

3. I desire to know how much tea,, at 16s. 14s. 9s. and 8s. per lb. will compose a mixture worth 10s. per lb. ?

Ans. 1 lb. at 16s. 2lb. at 14s. 6 lb. at 9s. and 4 lb. at 8s.

4. A farmer would mix as much barley at 3s. 6d. per bushel, rye at 4s. per bushel, and oats at 2s. per bushel, as to make a mixture worth 2s. 6d. per bushel. How much is that of each sort ?

Ans. 6 of barley, 6 of rye, and 30 of oats.

5. A grocer would mix raisins of the sun at 7d. per lb. with Malaga's, at 6d. and Smyrna's at 4d. per lb. I desire to know what quantity of each sort he must take to sell them at 5d. per lb. ?

Ans. 1lb. of raisins of the sun, 1lb. of Malaga's, and 3 lb. of Smyrna's.

6. A tobacconist would mix tobacco of 2s. 1s. 6d. and 1s. 3d. per lb. so as the compound may bear a price of 1s. 8d. per lb. What quantity of each sort must he take ?

Ans. 7 lb. at 2s. 4 lb. at 1s. 6d. and 4 lb. at 1s. 3d.

ALTERNATION PARTIAL

IS when the prices of all the simples, the quantity of but one of them, and the mean rate, are given, to find the several quantities of the rest in proportion to that given.

RULE. Take the difference between each price, and the mean rate, as before. Then,

As the difference of that simple, whose quantity is given : is to the rest of the differences severally : : so is the quantity given : to the several quantities required.

EXAMPLES.

1. A tobacconist being determined to mix 20 lb. of tobacco, at 15d. per lb. with others at 16d. per lb. 18d. per lb. and 22d. per lb. how many pounds of each sort must he take to make one pound of that mixture worth 17d. ?

<i>Answer.</i>		<i>Proof.</i>	
15	5	20 lb. at 15d. = 300d.	As 5 : 1 :: 20 : 4
16	1	4 lb. at 16d. = 64d.	As 5 : 1 :: 20 : 4
18	1	4 lb. at 18d. = 72d.	As 5 : 2 :: 20 : 8
22	2	8 lb. at 22d. = 176d.	

Ans. 36 lb. : 612d. :: 1 lb. : 17d.

H 3

2. A

2. A farmer would mix 20 bushels of wheat, at 60d. per bushel, with rye at 36d. barley at 24d. and oats at 18d. per bushel. How much must he take of each sort, to make the composition worth 32d. per bushel?

Ans. 20 bushels of wheat, 35 bushels of rye, 70 bushels of barley, and 10 bushels of oats.

3. A person is desirous of mixing wheat at 4s. per bushel, rye at 3s. per bushel, and barley at 2s. per bushel, with 12 bushels of oats, at 18d. per bushel. I would be glad to know how many bushels of each sort he must take to make the composition worth 3s. 6d. per bushel?

Ans. 96 bushels of wheat, 12 bushels of rye, 12 of barley, and 12 of oats.

4. A distiller would mix 40 gallons of French brandy, at 12s. per gallon, with English at 7s. and spirits at 4s. per gallon. What quantity of each sort must he take, to afford it for 8s. per gallon?

Ans. 40 gallons French, 32 English, and 32 spirits.

5. A grocer would mix teas of 12s. 10s. and 6s. with 20 lb. at 4s. per lb. How much of each sort must he take to make the composition worth 8s. per lb.?

Ans. 20 lb. at 4s. 10 lb. at 6s. 10 lb. at 10s. and 20 lb. at 12s.

6. A wine merchant is desirous of mixing 18 gallons of Canary, at 6s. 9d. per gallon, with Malaga, at 7s. 6d. per gallon; sherry, at 5s. per gallon; and white wine, at 4s. 3d. per gallon. How much of each sort must he take, that the mixture may be sold for 6s. per gallon?

Ans. 18 gallons of Canary, $31\frac{1}{2}$ of Malaga, $13\frac{1}{2}$ of sherry, and 27 of white wine.

ALTERNATION TOTAL

Is when the price of each simple, the quantity to be compounded, and the mean rate, are given, to find how much of each sort will make that quantity.

RULE. Take the difference between each price, and the mean rate, as before; then,

As the sum of the difference : is to each particular difference :: so is the quantity given : to the quantity required.

EXAMPLES.

EXAMPLES.

1. A grocer has four sorts of sugar, viz. 12*d.* 10*d.* 6*d.* and 4*d.* per lb. and would make a composition of 144 lb. worth 8*d.* per lb. I desire to know what quantity of each he must take.

	<i>Answer.</i>	<i>Proof.</i>
12	4 -- 48 at 12 <i>d.</i> 576	As 12 : 4 :: 144 : 48
10	2 -- 24 at 10 <i>d.</i> 240	As 12 : 2 :: 144 : 24
6	2 -- 24 at 6 <i>d.</i> 144	
4	4 -- 48 at 4 <i>d.</i> 142	
	<hr/> 12 144) 1152 (8 <i>d.</i>	

2. A druggist having four sorts of tea, of 5*s.* 6*s.* 8*s.* and 9*s.* per lb. would have a composition of 87 lb. worth 7*s.* per lb. What quantity must there be of each?

Ans. 14½ lb. of 5*s.* 29 lb. of 6*s.* 29 lb. of 8*s.* and 14½ lb. of 9*s.*

3. A vintner had four sorts of wine, viz. white wine, at 4*s.* per gallon; Flemish, at 6*s.* per gallon; Malaga, at 8*s.* per gallon; and Canary, at 10*s.* per gallon: would make a mixture of 60 gallons, to be worth 5*s.* per gallon. What quantity of each must he take?

Ans. 45 gallons of white wine, 5 gallons of Flemish, 5 gallons of Malaga, and 5 gallons of Canary.

4. A grocer having four sorts of currants, of 11*d.* 9*d.* 6*d.* and 4*d.* per lb. is desirous of making a composition of 240 lb. worth 8*d.* per lb. How much of each must he take?

Ans. 96 lb. at 11*d.* 48 lb. at 9*d.* 24 lb. at 6*d.* and 72 lb. at 4*d.*

5. A silversmith hath four sorts of gold, viz. of 24 carats fine, of 22, 20, and 15 carats fine; would make as much of each sort together, so as to have 42 oz. of 17 carats fine. How much must he take of each?

Ans. 4 of 24, 4 of 22, 4 of 20, and 30 of 15 carats fine.

6. A druggist having some drugs of 8*s.* 5*s.* and 4*s.* per lb. made them into two parcels; one of 28 lb. at 6*s.* per lb. the other of 42 lb. at 7*s.* per lb. How much of every sort did he take for each parcel?

Ans. 12 lb. of 8*s.*

8 lb. of 5*s.*

8 lb. of 4*s.*

28 lb. at 6*s.* per lb.

Ans. 30 lb. of 8*s.*

6 lb. of 5*s.*

6 lb. of 4*s.*

42 lb. at 7*s.* per lb.

POSITION.

POSITION, *or the* RULE OF FALSE,

IS a rule that, by false or supposed numbers, taken at pleasure, discovers the true ones required. It is divided into two parts; SINGLE and DOUBLE.

S I N G L E P O S I T I O N

Is, by using one supposed number, and working with it as the true one, you find the real number required, by the following

RULE. As the total of the errors: to the true total :: so the supposed number: to the true one required.

PROOF. Add the several parts of the sum together, and, if it agrees with the sum, it is right.

E X A M P L E S.

1. A schoolmaster being asked how many scholars he had, said, if I had as many, half as many, and one quarter as many more, I should have 88. How many had he? *Ans.* 32.

<i>Suppose he had</i> - 40	As 110 : 88 :: 40	32
<i>as many</i> - - 40	40	32
<i>half as many</i> - 20		16
$\frac{1}{4}$ <i>as many</i> - - 10	110)352|0(32	8
	110	88 <i>proof.</i>

2. A person having about him a certain number of Portugal pieces, said, if the third, fourth, and sixth of them were added together, they would make 54. I desire to know how many he had? *Ans.* 72.

3. A gentleman bought a chaise, horse and harness, for £60. the horse came to twice the price of the harness, and the chaise to twice the price of the horse and harness. What did he give for each.

Ans. Horse £13..6..8 Harness £6..13..4 Chaise £40.

4. A, B and C, being determined to buy a quantity of goods, which would cost them £120. agreed amongst themselves that B should have a third part more than A, and C a fourth part more than B. I desire to know what each man must pay.

Ans. A £30. B £40. C £50.
5. A man

5. A man overtaking a maid driving a flock of geese, said to her, How do you do, sweetheart? where are you going with these 30 geese? No, Sir, said she, I have not 30; but if I had as many more, half as many more, and 5 geese besides, I should have 30. How many had she?

Ans. 10.

6. A person delivered to another a sum of money, unknown, to receive interest for the same at 6 per cent. per annum, simple interest, and at the end of ten years received for principal and interest £300. What was the sum lent?

Ans. £187..10..-

DOUBLE POSITION

Is by making use of two supposed numbers, and if both prove false, (as it generally happens) they are with their errors to be thus ordered.

RULE 1. Place each error against its respective position.

2. Multiply them cross-wise.

3. If the errors are alike, *i.e.* both greater, or both less than the given number, take their difference for a divisor, and the difference of their products for a dividend. But if unlike, take their sum for a divisor, and the sum of their products for a dividend, the quotient will be the answer.

EXAMPLES.

1. A, B and C, would divide £200. between them, so that B may have £6. more than A, and C £8. more than B. How much must each have?

<i>Suppose A had</i> 40	<i>Then suppose A had</i> 50
<i>then B had</i> 46	<i>then B must have</i> 56
<i>and C - -</i> 54	<i>and C - - - -</i> 64

140 too little by 60

170 too little by 30.

sup. errors.

$$\begin{array}{r} 40 \times 60 \\ 50 \times 30 \\ \hline \end{array}$$

$$\begin{array}{r} 3000 \quad 1200 \\ 1200 \\ \hline \end{array}$$

60

30

30 divisor.

60 A

66 B

74 C

200 proof.

$$310 \overline{) 1800}$$

60 *Ans. for A.*

2. A

82 *Position, or the Rule of False.* The TUTOR'S

2. A man had two silver cups, of unequal weight, having one cover to both, of 5 oz. now if the cover is put on the lesser cup, it will double the weight of the greater cup; and set on the greater cup, it will be thrice as heavy as the lesser cup. What is the weight of each cup?

Ans. 3 ounces lesser; 4 greater.

3. A, B and C, playing at hazard together, the money staked was 196 guineas; but disagreeing, each seized as many as he could: A got a certain quantity; B as many as A, and 16 more; and C the 6th part of both their sums. How many had each?

Ans. A 76; B 92; and C 28.

4. A gentleman bought a house with a garden, and a horse in the stable, for £500. now he paid 4 times the price of the horse for the garden, and 5 times the price of the garden for the house. What was the value of the house, garden, and horse, separately?

Ans. horse £20. garden 80. house 400.

5. Three persons discoursed concerning their ages; says H, I am 30 years of age; says K, I am as old as H, and $\frac{1}{4}$ of L; and says L, I am as old as you both. What was the age of each person?

Ans. H 30; K 50; and L 80.

6. D, E and F, playing at cards, staked 324 crowns; but disputing about the tricks, each man took as many as he could: D got a certain number; E as many as D, and 15 more; and F got a 5th part of both their sum added together. How many did each get?

Ans. D $127\frac{1}{2}$; E $142\frac{1}{2}$; and F 54.

7. A, stealing apples, was taken by B, and to appease him gave him half of what he had, and B gives him back 10; going farther he meets C, who took from him half of what he had left, and gives him back 4: after that, meeting with D, he gives him half of what he had, and he returns him back 1; at last getting safe away, he finds he had 13 left. How many had he at first? *Ans.* 60.

8. A gentleman going into a garden, meets with some ladies, and says to them, Good-morning to you 10 fair maids. Sir, you mistake, answered one of them, we are not 10; but if we were twice as many more as we are, we should be as many above 10 as we are now under. How many were they? *Ans.* 5.

EXCHANGE

E X C H A N G E

IS the receiving money in one country for the same value paid in another.

The Par of Exchange is always fixed and certain, it being the intrinsic value of foreign money, compared with sterling; but the Course of Exchange rises and falls, upon various occasions.

I. F R A N C E.

They keep their accounts at Paris, Lyons, and Rouen, in livres, sols, and deniers, and exchange by the crown, =4s. 6d. at par.

NOTE. 12 deniers make 1 sol.
20 sols - - - 1 livre.
3 livres - - - 1 crown.

To change French into Sterling.

RULE. As 1 crown: is to the given rate :: so is the French sum: to the sterling required.

To change Sterling into French.

RULE. As the rate of exchange: is to 1 crown :: so is the sterling sum: to the French required.

E X A M P L E S.

1. How many crowns must be paid at Paris, to receive in London £180. exchange at 4s. 6d. per crown?

d.	c.	£.
As 54	: 1	: : 180 :
		240
		<u> </u> crowns.
		54)43200(800
		432
		<u> </u>
		...
		<u> </u>

2. A merchant at Paris remits to his correspondent in London 800 crowns, at 4s. 6d. each; what is the value in sterling?

cr.	d.	cr.
1	: 54	: : 800 :
		54
		<u> </u>
		12)43200
		<u> </u>
		210)36010
		<u> </u>
		£ 180

3. How much sterling must be paid in London, to receive in Paris 758 crowns, exchange at 56d. per crown?

Ans. £176..17..4.

4. A

4. A merchant in London remits £176..17..4. to his correspondent at Paris; what is the value of French crowns, at 56*d.* per crown? *Ans.* 758.

5. Change 725 crowns, 17 *sols*, 7 deniers, at 54*d.* $\frac{1}{2}$ per crown, into sterling, what is the sum? *Ans.* £164..14.. $\frac{1}{2}$.

6. Change £164..14.. $\frac{1}{2}$. sterling into French crowns, exchange at 54*d.* $\frac{1}{2}$ per crown?

Ans. 725 crowns, 17 *sols*, 7 deniers.

II. S P A I N.

They keep their accounts at Madrid, Cadiz, and Seville, in dollars, rials, and maravedies, and exchanged by the piece of eight=4*s.* 6*d.* at par.

NOTE. 34 *maravedies* make 1 *rial*.

8 *rials* - - - - 1 *piastre*, or piece of eight.

10 *rials* - - - - 1 *dollar*.

RULE. As with France.

E X A M P L E S.

7. A merchant at Cadiz remits to London 2547 pieces of eight, at 56*d.* per piece, how much sterling is the sum?

Ans. £594..6..-

8. How many pieces of eight, at 56*d.* each, will answer a bill of £594..6..-. sterling? *Ans.* 2547.

9. If I pay a bill here of £2500. what Spanish money may I draw my bill for at Madrid, exchange at 57*d.* $\frac{1}{2}$ per piece of eight? *Ans.* 10434 pieces of eight, 6 *rials*, 8 *mar.*

III. I T A L Y.

They keep their accounts at Genoa and Leghorn, in *livres*, *sols*, and deniers, and exchange by the piece of eight, or dollar=4*s.* 6*d.* at par.

NOTE. 12 *deniers* make 1 *sol*.

20 *sols* - - - - 1 *livre*.

5 *livres* - - - 1 piece of eight at Genoa.

6 *livres* - - - 1 piece of eight at Leghorn.

N. B. The exchange at Florence is by ducatoons; the exchange at Venice by ducats.

NOTE. 6 *solidi* make 1 *gross*.

24 *grosses* - - 1 *ducat*.

RULE. The same as before.

10. How much sterling money may a person receive in London, if he pays in Genoa 976 dollars, at 53*d.* per dollar?

Ans. £215..10..8.

11. A merchant remitted £215..10..8. sterling to Leghorn, how many dollars will he receive there, the exchange being at 53*d.* per dollar?

Ans. 976.

12. A factor hath sold goods at Florence, for 250 ducatoons, at 54*d.* each, what is the value in pounds sterling?

Ans. £56..5..-

13. A bill of 56..5..- is remitted to Florence to be paid in ducatoons, at 54*d.* each, how many will be received?

Ans. 250.

14. If 275 ducats, at 4*s.* 5*d.* each, be remitted from Venice to London, what is the value in pounds sterling?

Ans. £60..14..7.

15. A gentleman travelling, would exchange £60..14..7. sterling for Venice ducats, at 4*s.* 5*d.* each, how many must he receive?

Ans. 275.

IV. PORTUGAL.

They keep their accounts in Oporto and Lisbon, in *reas*, and exchange on the *milrea*, = 6*s.* 8*d.* $\frac{1}{2}$ at par.

NOTE. 1000 *reas* make 1 *milrea*.

RULE. The same as with France.

EXAMPLES.

16. A gentleman being desirous to remit to his correspondent in London 2750 milreas, exchange at 6*s.* 5*d.* per milrea, how much sterling will he be the creditor for in London?

Ans. £882..5..10.

17. If a bill be drawn from London of £882..5..10. sterling, how many milreas, at 6*s.* 5*d.* each, is equal in value to the said sum?

Ans. 2750.

18. A merchant at Oporto remits to London 4366 milreas, and 183 reas, at 5*s.* 5*d.* $\frac{5}{8}$ exchange per milrea, how much sterling must be paid in London for this remittance?

Ans. £1193..17..6 $\frac{1}{4}$.

19. If I pay a bill at London of £1193..17..6 $\frac{1}{4}$. what must I draw for on my correspondent at Lisbon, exchange at 5*s.* 5*d.* $\frac{5}{8}$ per milrea?

Ans. 4366 milreas, 183 reas.

V. HOLLAND, FLANDERS, and GERMANY.

They keep their accounts at Antwerp, Amsterdam, Brussels, Rotterdam, and Hamburgh; some in pounds, shillings, and pence, as in England; others in guilders, stivers, and pennings; and exchange with us in our pound, at 33s. 4d. Flemish, as par.

NOTE. 8 pennings - make - 1 groat.
 2 groats or 16 pennings 1 stiver.
 20 stivers - - - - 1 guilder or florin.

A L S O

12 groats or 6 stivers - make 1 schelling.
 20 schellings or 6 guilders - 1 pound.

To change Flemish into Sterling.

RULE. As the given rate : is to 1 pound :: so is the Flemish sum : to the sterling required.

To change Sterling into Flemish.

RULE. As £1. sterling : is to the given rate :: so is the sterling given : to the Flemish sought.

E X A M P L E S.

20. Remitted from London to Amsterdam, a bill of £754.10.-. sterling, how many pounds Flemish is the sum, the exchange at 33s. 6d. Flemish per pound sterling?

Ans. £1263..15..9. Flemish.

21. A merchant at Rotterdam remits £1263..15..9. Flemish to be paid in London, how much sterling money must he draw for, the exchange being at 33s. 6d. Flemish per pound sterling?

Ans. £754..10.-.

22. If I pay in London £852..12..6. sterling, how many guilders must I draw for at Amsterdam, exchange at 34 schel. 4 $\frac{1}{2}$ groats Flemish per pound sterling?

Ans. 8792 guild. 13 stiv. 14 $\frac{1}{2}$ pennings.

23. What must I draw for at London, if I pay at Amsterdam 8792 guild. 13 stiv. 14 $\frac{1}{2}$ pennings, exchange at 34 schel. 4 $\frac{1}{2}$ groats per pound sterling?

Ans. £852..12..6.

To

To convert Bank Money into Current, and the contrary.

NOTE. *The Bank money is worth more than the Current. The difference between the one and the other is called agio, and is generally from 3 to 6 per cent. in favour of the Bank.*

To change Bank into Current money.

RULE. As 100 guilders Bank : is to 100 with the agio added : : so is the Bank given : to the current required.

To change Current money into Bank.

RULE. As 100, with the agio added : is to 100 Bank : : so is the Current money given : to the Bank required.

24. Change 794 guilders, 15 stivers, Current money, into Bank florins, agio $4\frac{3}{8}$ per cent.

Ans. 761 guilders, 8 stivers, 11 pennings.

25. Change 761 guilders, 9 stivers, Bank, into Current money, agio $4\frac{3}{8}$ per cent.

Ans. 794 guilders, 15 stivers, 4 pennings.

VI. I R E L A N D.

26. A Gentleman remits to Ireland £575..15..-. sterling, what will he receive there, the exchange being at 10 per cent.?

Ans. £633..6..6.

27. What must be paid in London for a remittance of £633..6..6. Irish, exchange at 10 per cent.?

Ans. £575..15..-.

COMPARISON of WEIGHTS and MEASURES.

EXAMPLES.

1. If 50 Dutch pence be worth 65 French pence, how many Dutch pence are equal to 350 French pence?

Ans. 269 $\frac{15}{65}$.

2. If 12 yards at London make 8 ellis at Paris, how many ellis at Paris will make 64 yards at London?

Ans. 42 $\frac{8}{12}$.

3. If 30 lb. at London make 28 lb. at Amsterdam, how many lb. at London will be equal to 350 lb. at Amsterdam?

Ans. 375.

4. If 95 lb. Flemish make 100 lb. English, how many lb. English are equal to 275 lb. Flemish?

Ans. 289 $\frac{45}{95}$.

CONJOINED PROPORTION

IS when the coin, weight, or measures of several countries are compared in the same question; or it is linking together a variety of proportions.

When it is required to find how many of the first sort of coin, weight, or measure mentioned in the question, are equal to a given quantity of the last,

RULE. Place the numbers alternately, beginning at the left-hand, and let the last number stand on the left-hand; then multiply the first row continually for a dividend, and the second for a divisor.

PROOF. By as many single Rules of Three as the question requires.

EXAMPLES.

1. If 20 lb. at London make 23 lb. at Antwerp, and 155 lb. at Antwerp, make 180 lb. at Leghorn, how many lb. at London are equal to 72 lb. at Leghorn?

Left. Right.

$$\begin{array}{rcl} 20 & 23 & 20 \times 155 \times 72 = 223200. \\ 155 & 180 & 23 \times 180 = 4140)223200(53\frac{378}{14}. \\ 72 & & \end{array}$$

2. If 12 lb. at London make 10 lb. at Amsterdam, 100 lb. at Amsterdam 120 lb. at Thoulouse, how many lb. at London is equal to 40 lb. at Thoulouse? *Ans.* 40.

3. If 140 braces at Venice are equal to 156 braces at Leghorn, and 7 braces at Leghorn equal to 4 ells English, how many braces at Venice are equal to 16 ells English?

Ans. $25\frac{80}{24}$.

4. If 40 lb. at London make 36 lb. at Amsterdam, and 90 lb. at Amsterdam make 116 lb. at Dantzick, how many lb. at London are equal to 130 lb. at Dantzick?

Ans. $112\frac{288}{1176}$.

When it is required to find how many of the last sort of coin, weight, or measure, mentioned in the question, is equal to a quantity of the first,

RULE. Place the numbers alternately, beginning at the left-hand, and let the last number stand on the right-hand; then multiply the first row for a divisor, and the second for a dividend.

EXAMPLES.

EXAMPLES.

5. If 12lb. at London make 10lb. at Amsterdam, 100 lb. at Amsterdam 120lb. at Thoulouse, how many lb. at Thoulouse are equal to 40 lb. at London. *Ans.* 40lb.

6. If 40 lb. at London make 36 lb. at Amsterdam, and 90 lb. at Amsterdam 116 lb. at Dantzick, how many lb. at Dantzick are equal to 122 lb. at London? *Ans.* $141\frac{1872}{3600}$.

P R O G R E S S I O N

Consists of TWO PARTS:

ARITHMETICAL and GEOMETRICAL.

ARITHMETICAL PROGRESSION

IS. when the rank of numbers increase or decrease regularly by the continual adding or subtracting of the equal numbers: As 1, 2, 3, 4, 5, 6, are in Arithmetical Progression by the continual increasing or adding of one; 11, 9, 7, 5, 3, 1, by the continual decreasing and subtracting of two.

NOTE. When any even number of terms differ by Arithmetical Progression, the sum of the two extremes will be equal to the two middle numbers, or any two means equally distant from the extremes; as, 2, 4, 6, 8, 10, 12 where $6+8$, the two middle numbers are $= 12 + 2$, the two extremes, and $= 10 + 4$ the two means, $= 14$.

When the number of terms are odd, the double of the middle term will be equal to the two extremes, or of any two means equally distant from the middle term; as 1, 2, 3, 4, 5, where the double of 3 $= 5 + 1 = 2 + 4 = 6$.

In Arithmetical Progression five things are to be observed, viz.

1. The first term; better expressed thus, F.
2. The last term, - - - - - L.
3. The number of terms, - - - - - N.
4. The equal difference, - - - - - D.
5. The sum of all the terms, - - - - - S.

Any three of which being given, the other two may be found.

The first, second, and third terms given, to find the fifth.

RULE. Multiply the sum of the two extremes by half the number of terms, or multiply half the sum of the two extremes by the whole number of terms, the product is the total of all the terms : *or thus,*

I. F. L. N. are given, to find S.

$$\frac{F + L \times \frac{N}{2}}{2} = S.$$

EXAMPLES.

1. How many strokes does the hammer of a clock strike in 12 hours? *Ans.* 78.

Ans. 78.

$$12 + 1 = 13 \text{ then } 13 \times 6 = 78$$

2. A man buys 17 yards of cloth, and gave for the first yard 2s. and for the last 10s. what did the 17 yards amount to? *Ans.* £5..2..-.

Ans. £5..2..-.

3. If 100 eggs were placed in a right line, exactly a yard
apunder from one another, and the first a yard from a basket,
what length of ground does that man go who gathers up these
100 eggs singly, returning with every egg to the basket to put
it in? *Ans. 5 miles 1300 yards.*

Ans. 5 miles 1300 yards.

The first, second, and third terms given to find the fourth.

RULE. From the second subtract the first, the remainder divided by the third less one, gives the fourth: or thus,

II. F. L. N. are given, to find D.

$$\frac{L - F}{N - 1} = D.$$

EXAMPLES.

4. A man had eight sons, the youngest was 4 years old; and the eldest 32, they increase in Arithmetical Progression, what was the common difference of their ages? *Ans.* 4.

Ans. 4.

$32 - 4 = 28$ then $28 \div 8 - 1 = 4$ common difference.

5. A man is to travel from London to a certain place in 12 days, and to go but 3 miles the first day, increasing every day by an equal excess, so that the last day's journey may be 58 miles, what is the daily increase, and how many miles distant is that place from London? *Ans. 5 daily increase.*

Ans. 5 daily increase.

Therefore, as 3 miles is the first day's journey,

$3 + 5 = 8$ the second day,

$8 + 5 = 13$ the third day, &c.

The whole distance is 366 miles.

The first, second, and fourth terms given, to find the third.

RULE. From the second subtract the first, the remainder divide by the fourth, and to the quotient add 1, gives the third: *or thus,*

III. F. L. D. are given, to find N.

$$\begin{array}{r} L - F \\ \hline \quad \quad + 1 = N. \\ D \end{array}$$

EXAMPLES.

6. A person travelling into the country, went 3 miles the first day, and increased every day by 5 miles, till at last he went 58 miles in one day, how many days did he travel?

Ans. 12.

$58 - 3 = 55$, then $55 \div 5 = 11 + 1 = 12$ the number of days.

7. A man being asked how many sons he had, said, that the youngest was 4 years old, and the eldest 32, and that he increased one in his family every four years, how many had he?

Ans. 8.

The second, third, and fourth terms given, to find the first.

RULE. Multiply the fourth by the third made less by 1, the product subtracted from the second gives the first: *or, thus,*

IV. L. N. D. are given, to find F.

$$L - D \div N - 1 = F.$$

EXAMPLES.

8. A man in 10 days went from London to a certain town in the country, every day's journey increasing the former by 4, and the last he went was 46 miles, what was the first?

Ans. 10 miles.

$4 \times 10 - 1 = 36$, then $46 - 36 = 10$, the first day's journey.

9. A man takes out of his pocket at 8 several times, so many different numbers of shillings, every one exceeding the former by 6, the last 46, what was the first? *Ans.* 4.

The fourth, third, and fifth given, to find the first.

RULE. Divide the fifth by the third, and from the quotient subtract half the product of the fourth multiplied by the third less 1 gives the first: *or, thus,*

V. N. D. S. are given, to find F.

$$\begin{array}{r} S \quad D \times N - 1 \\ \hline N \quad \quad 2 \end{array} = F$$

EXAMPLES

EXAMPLES.

10. A man is to receive £360. at 12 several payments, each to exceed the former by £4. and is willing to bestow the first payment on any one that can tell him what it is. What will that person have for his pains? *Ans.* £8.

$$360 \div 12 = 30 \text{ then } 30 - \frac{4 \times 12 - 1}{2} = 8 \text{ the first payment.}$$

The first, third, and fourth given, to find the second.

RULE. Subtract the fourth from the product of the third, multiplied by the fourth, that remainder added to the first gives the second: *or thus,*

VI. F. N. D are given, to find L.
 $ND - D + F = L.$

EXAMPLES.

11. What is the last number of an Arithmetical Progression, beginning at 6, and continuing by the increase of 8 to 20 places? *Ans.* 158.

$$20 \times 8 - 8 = 152, \text{ then } 152 + 6 = 158. \text{ the last number.}$$

GEOMETRICAL PROGRESSION

IS the increasing or decreasing of any rank of numbers by some common ratio; that is, by the continual multiplication or division of some equal number: as 2, 4, 8, 16, increase by the multiplier 2, and 16, 8, 4, 2, decrease by the divisor 2.

NOTE. When any number of terms is continued in geometrical progression, the product of the two extremes will be equal to any two means, equally distant from the extremes: as 2, 4, 8, 16, 32, 64, where $64 \times 2 = 4 \times 32$, and $8 \times 16 = 128$.

When

When the number of terms are odd, the middle term multiplied into itself will be equal to the two extremes, or any two means, equally distant from the mean: as 2, 4, 8, 16, 32, where $2 \times 32 = 4 \times 16 = 8 \times 8 = 64$.

In Geometrical Progression the same five things are to be observed as in Arithmetical, viz.

1. The first term.
2. The last term.
3. The number of terms.
4. The equal difference or ratio.
5. The sum of all the terms.

NOTE. *As the last term in a long series of numbers is very tedious to come at, by continual multiplication; therefore, for the reader finding it out, there is a series of numbers made use of in Arithmetical Proportion, called indices, beginning with an unit, whose common difference is one; whatever number of indices you make use of, set as many numbers (in such geometrical proportion as is given in the question) under them:*

As 1, 2, 3, 4, 5, 6. Indices.
2, 4, 8, 16, 32, 64. Numbers in geometrical proportion.

But if the first term in geometrical proportion be different from the ratio, the indices must begin with a cypher.

As 0, 1, 2, 3, 4, 5, 6. Indices.
1, 2, 4, 8, 16, 32, 64. Numbers in geometrical proportion.

When the indices begin with a cypher, the sum of the indices made choice of must always be one less than the number of terms given in the question; for 1 in the indices is over the second term, and two over the third, &c.

Add any two of the indices together, and that sum will agree with the product of their respective terms.

As in the first table of indices $2 + 5 = 7$
Geometrical proportion $4 \times 32 = 128$

Then in the second $2 + 4 = 6$
 $4 \times 16 = 64$

In any Geometrical Progression proceeding from unity, the ratio being known, to find any remote term, without producing all the intermediate terms.

RULE. Find what figures of the Indices added together would give the exponent of the term wanted: then multiply the numbers standing under such exponent into each other, and it will give the term required.

Note. When the exponent 1 stands over the second term, the number of exponents must be 1 less than the number of terms.

EXAMPLES.

1. A man agrees for 12 peaches, to pay only the price of the last, reckoning a farthing for the first, an half-penny for the second, &c. doubling the price to the last, what must he give for them?

Ans. £2..2..8.

0, 1, 2, 3, 4, Exponents.

$$16 = 4$$

1, 2, 4, 8, 16, No. of terms.

$$16 = 4$$

$$256 = 8$$

$$8 = 3$$

For $4 + 4 + 3 = 11$, No. of terms less 1. ———

$$4)2048 = 11 \text{ No. of far-}$$

$$12)512$$

$$2|0)4|2..8$$

$$2..2..8$$

2. A country gentleman going to a fair to buy some oxen, meets with a person who had 23; he demanded the price of them, was answered £16. a piece: the gentleman bids him £15. a piece, and he would buy all: the other tells him it could not be taken; but if he would give what the last ox would come to, at a farthing for the first, and doubling it to the last, he should have all. What was the price of the oxen?

Ans. £4369..1..4.

In any Geometrical Progression, not proceeding from unity, the ratio being given, to find any remote term, without producing all the intermediate terms.

RULE. Proceed as in the last, only observe that every product must be divided by the first term.

EXAMPLES.

EXAMPLES.

3. A sum of money is to be divided among 8 persons, the first to have £20. the second £60. and so on in triple proportion; what will the last have?

Ans. £43740.

$$540 \times 540$$

$$14580 \times 60$$

$$\begin{array}{ccccccc} 0, & 1, & 2, & 3, & \text{---} & = 14580 & \text{then} \text{---} = 43740 \\ 20, & 60, & 180, & 540, & & & \end{array}$$

20

20

$3 + 3 + 1 = 7$, one less than the number of terms.

4. A gentleman dying left nine sons, to whom and to his executors he bequeathed his estate in manner following: To his executors £50. his youngest son was to have as much more as the executors, and each son to exceed the next younger by as much more; what was the eldest son's portion?

Ans. £25600.

The first term, ratio, and number of terms given, to find the sum of all the terms.

RULE. Find the last term as before, then subtract the first from it, and divide the remainder by the ratio, less one; to the quotient of which add the greater, gives the sum required.

EXAMPLE.

5. A servant skilled in numbers agreed with a gentleman to serve him twelve months, provided he would give him a farthing for his first month's service, a penny for the second, and 4d. for the third, &c. what did his wages amount to?

Ans. £5825..8..5¼.

$$256 \times 256 = 65536 \text{ then } 65536 \times 64 = 4194304$$

$$0, 1, 2, 3, 4, \quad 4194304 - 1$$

$$1, 4, 16, 64, 256, \quad \text{---} = 1398101, \text{ then}$$

$$4 + 4 + 3 = 11, \text{ No. of terms less 1. } 4 - 1$$

$$1398101 + 4194304 = 5592405 \text{ farthings.}$$

6. A man bought a horse, and by agreement was to give a farthing for the first nail, three for the second, &c. there were four shoes, and in each shoe 8 nails; what was the worth of the horse?

Ans. £965114681693..13..4

7. A certain person married his daughter on New-year's day, and gave her husband 1s. towards her portion, promising to double it on the first day of every month for one year; what was her portion?

Ans. £204..15..-

8. A laceman

8. A laceman, well versed in numbers, agreed with a gentleman to sell him 22 yards of rich gold brocade lace, for 2 pins the first yard, 6 pins the second, &c. in triple proportion. I desire to know what he sold the lace for, if the pins were valued at 100 for a farthing; also what the laceman got or lost by the sale thereof, supposing the lace stood him in £7. per yard?

Ans. The lace sold for £326886...9.
£326732...9.

P E R M U T A T I O N

IS the changing or varying the order of things.

RULE. Multiply all the given terms one into another, and the last product will be the number of changes required.

E X A M P L E S.

1. How many changes may be rung upon 12 bells; and how long would they be ringing but once over, supposing 10 changes might be rung in 1 minute, and the year to contain 365 days, 6 hours?

Answer.

$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 = 479001600$
changes, which $\div 10 = 47900160$ minutes; and, if reduced, is $= 91$ years, 3 weeks, 5 days, 6 hours.

2. A young scholar coming into town for the convenience of a good library, demands of a gentleman with whom he lodged, what his diet would cost for a year; who told him £10. but the scholar not being certain what time he should stay, asked him what he must give him for so long as he should place his family (consisting of 6 persons besides himself) in different positions, every day at dinner: the gentleman thinking it would not be long, tells him £5. to which the scholar agrees. What time did the scholar stay with the gentleman?

Ans. 5040 days.

THE
TUTOR'S ASSISTANT.

PART II.

VULGAR FRACTIONS.

A FRACTION is a part or parts of an unit, and written with two figures, with a line between them, as $\frac{1}{4}$, $\frac{5}{6}$, $\frac{3}{8}$, &c.

The figure above the line is called the numerator, and the under one the denominator; which shews how many parts the unit is divided into; and the numerator shews how many of those parts are meant by the fraction.

There are four sorts of Vulgar Fractions; *proper*, *improper*, *compound*, and *mixed*; viz.

1. A PROPER FRACTION is when the numerator is less than the denominator, as $\frac{2}{4}$, $\frac{3}{6}$, $\frac{7}{8}$, $\frac{9}{11}$, $\frac{101}{701}$, &c.

2. An IMPROPER FRACTION is when the numerator is equal to, or greater than the denominator, as $\frac{5}{3}$, $\frac{8}{4}$, $\frac{12}{12}$, $\frac{197}{2}$, &c.

3. A COMPOUND FRACTION is the fraction of a fraction, and known by the word *of*, as $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{7}{9}$ of $\frac{8}{11}$ of $\frac{9}{12}$, &c.

4. A MIXED NUMBER OR FRACTION is composed of a whole number and fraction, as $8\frac{2}{7}$, $17\frac{1}{2}$, $8\frac{71}{97}$, &c.

REDUCTION of VULGAR FRACTIONS.

- 1.
- To reduce fractions to a common denominator.*

RULE 1. Multiply each numerator into all the denominators, except its own, for a new numerator; and all the denominators for a common denominator. Or,

2. Multiply the common denominator by the several given numerators separately, and divide the product by their several denominators, the quotients will be the new numerators.

EXAMPLES.

1. Reduce
- $\frac{2}{4}$
- and
- $\frac{4}{7}$
- to a common denominator.

Facit $\frac{14}{28}$, and $\frac{16}{28}$.

1st num.

2d num.

$2 \times 7 = 14$

$4 \times 4 = 16$ then $4 \times 7 = 28$ den. $= \frac{12}{28}$, and $\frac{16}{28}$.

2. Reduce
- $\frac{1}{2}$
- ,
- $\frac{3}{4}$
- , and
- $\frac{5}{8}$
- to a common denominator.

Facit $\frac{32}{64}$, $\frac{48}{64}$, $\frac{40}{64}$.

3. Reduce
- $\frac{7}{8}$
- ,
- $\frac{4}{6}$
- ,
- $\frac{6}{10}$
- , and
- $\frac{6}{7}$
- to a common denominator.

Facit $\frac{2940}{3360}$, $\frac{2240}{3360}$, $\frac{2016}{3360}$, $\frac{2880}{3360}$.

4. Reduce
- $\frac{6}{10}$
- ,
- $\frac{2}{4}$
- ,
- $\frac{1}{7}$
- ,
- $\frac{3}{6}$
- , to a common denominator.

Facit $\frac{1008}{1680}$, $\frac{840}{1680}$, $\frac{240}{1680}$, $\frac{840}{1680}$.

5. Reduce
- $\frac{4}{5}$
- ,
- $\frac{2}{3}$
- ,
- $\frac{3}{7}$
- , and
- $\frac{1}{8}$
- to a common denominator.

Facit $\frac{672}{840}$, $\frac{560}{840}$, $\frac{360}{840}$, $\frac{105}{840}$.

6. Reduce
- $\frac{2}{6}$
- ,
- $\frac{5}{9}$
- ,
- $\frac{2}{8}$
- , and
- $\frac{3}{5}$
- to a common denominator.

Facit $\frac{720}{2160}$, $\frac{1200}{2160}$, $\frac{540}{2160}$, $\frac{1296}{2160}$.

- 2.
- To reduce a vulgar fraction to its lowest terms.*

RULE. Find a common measure by dividing the lower term by the upper, and that divisor by the remainder following, till nothing remain; the last divisor is the common measure; then divide both parts of the fraction by the common measure, and the quotient will give the fraction required.

Note, If the common measure happen to be 1, the fraction is already in its lowest term; and when a fraction hath cyphers at the right-hand, it may be abbreviated by cutting them off; as $\frac{310}{410}$.

EXAMPLES.

7. Reduce
- $\frac{24}{32}$
- to its lowest terms.

$$\begin{array}{r} 24 \overline{) 32} 1 \\ \underline{} \end{array}$$

then $8 \overline{) \frac{24}{32}} (= \frac{3}{4})$ Facit.

$$\text{com. measure } 8 \overline{) 24} 3$$

8. Reduce

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8. Reduce $\frac{30}{125}$ to its lowest terms. *Facit* $\frac{6}{25}$.
9. Reduce $\frac{208}{684}$ to its lowest terms. *Facit* $\frac{52}{171}$.
10. Reduce $\frac{192}{576}$ to its lowest terms. *Facit* $\frac{1}{3}$.
11. Reduce $\frac{825}{960}$ to its lowest terms. *Facit* $\frac{55}{64}$.
12. Reduce $\frac{5184}{6912}$ to its lowest terms. *Facit* $\frac{3}{4}$.

3. *To reduce a mixed number to an improper fraction.*

RULE. Multiply the whole number by the denominator of the fraction, and to the product add the numerator for a numerator, which place over the denominator.

Note, *To express a whole number fraction-ways, set 1 for the denominator given.*

EXAMPLES.

13. Reduce $18\frac{3}{7}$ to an improper fraction. *Facit* $129\frac{3}{7}$.
 $18 \times 7 + 3 = 129$ new numerator, $129\frac{3}{7}$.
14. Reduce $56\frac{13}{21}$ to an improper fraction. *Facit* $1245\frac{13}{21}$.
15. Reduce $183\frac{5}{21}$ to an improper fraction. *Facit* $3848\frac{5}{21}$.
16. Reduce $13\frac{4}{5}$ to an improper fraction. *Facit* $69\frac{4}{5}$.
17. Reduce $27\frac{2}{9}$ to an improper fraction. *Facit* $245\frac{2}{9}$.
18. Reduce $514\frac{5}{16}$ to an improper fraction. *Facit* $8229\frac{5}{16}$.

4. *To reduce an improper fraction to its proper terms.*

RULE. Divide the upper term by the lower.

EXAMPLES.

19. Reduce $129\frac{3}{7}$ to its proper terms. *Facit* $18\frac{3}{7}$.
 $129 \div 7 = 18\frac{3}{7}$.
20. Reduce $1245\frac{13}{21}$ to its proper terms. *Facit* $56\frac{13}{21}$.
21. Reduce $3848\frac{5}{21}$ to its proper terms. *Facit* $183\frac{5}{21}$.
22. Reduce $69\frac{4}{5}$ to its proper terms. *Facit* $13\frac{4}{5}$.
23. Reduce $245\frac{2}{9}$ to its proper terms. *Facit* $27\frac{2}{9}$.
24. Reduce $8229\frac{5}{16}$ to its proper terms. *Facit* $514\frac{5}{16}$.

5. *To reduce a compound fraction to a single one.*

RULE. Multiply all the numerators for a new numerator, and all the denominators for a new denominator.

Reduce the new fraction to its lowest terms, by RULE 2.

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EXAMPLES.

25. Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{5}{8}$ to a single fraction.

Facit $\frac{2 \times 3 \times 5 = 30}{3 \times 5 \times 8 = 120}$ reduced to the lowest term $= \frac{1}{4}$.

26. Reduce $\frac{5}{9}$ of $\frac{4}{7}$ of $\frac{1}{12}$ to a single fraction.

Facit $\frac{220}{756} = \frac{55}{189}$.

27. Reduce $\frac{1}{12}$ of $\frac{13}{14}$ of $\frac{2}{9}$ to a single fraction.

Facit $\frac{3003}{4872} = \frac{143}{232}$.

28. Reduce $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$ to a single fraction.

Facit $\frac{135}{240} = \frac{9}{16}$.

29. Reduce $\frac{4}{5}$ of $\frac{6}{8}$ of $\frac{7}{9}$ to a single fraction.

Facit $\frac{168}{360} = \frac{7}{15}$.

30. Reduce $\frac{2}{7}$ of $\frac{5}{9}$ of $\frac{8}{10}$ to a single fraction.

Facit $\frac{80}{630} = \frac{8}{63}$.

6. To reduce fractions of one denomination to the fraction of another, but greater, retaining the same value.

RULE. Reduce the given fraction to a compound one, by comparing it with all the denominations between it, and that denomination which you would reduce it to; then reduce that compound fraction to a single one.

EXAMPLES.

31. Reduce $\frac{7}{8}$ of a penny to the fraction of a pound.

Facit $\frac{7}{8}$ of $\frac{1}{12}$ of $\frac{1}{20} = \frac{7}{1920}$.

32. Reduce $\frac{1}{4}$ of a penny to the fraction of a pound.

Facit $\frac{1}{960}$.

33. Reduce $\frac{4}{5}$ of a dwt. to the fraction of a lb. troy.

Facit $\frac{4}{1260}$.

34. Reduce $\frac{4}{7}$ of a lb. avoirdupoise to the fraction of an cwt.

Facit $\frac{4}{784}$.

7. To reduce fractions of one denomination to the fraction of another, but less, retaining the same value.

RULE. Multiply the numerator by the parts contained in the several denominations between it, and that you would reduce it to, for a new numerator, and place it over the given denominator.

Reduce the new fraction to its lowest terms.

EXAMPLES.

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EXAMPLES.

35. Reduce $\frac{7}{1920}$ of a pound to the fraction of a penny.

Facit $\frac{7}{8}$.

$7 \times 20 \times 12 = 1680$ $\frac{1680}{1920}$ reduced to its lowest term $= \frac{7}{8}$.

36. Reduce $\frac{1}{960}$ of a pound to the fraction of a penny.

Facit $\frac{1}{4}$.

37. Reduce $\frac{4}{1200}$ of a lb. troy to the fraction of a penny-weight.

Facit $\frac{4}{5}$.

38. Reduce $\frac{4}{784}$ of an cwt. to the fraction of a lb.

Facit $\frac{4}{7}$.

8. To reduce fractions of one denomination to another of the same value, having the numerator given of the required fraction.

RULE. As the numerator of the given fraction: is to its denominator: : so is the numerator of the intended fraction: to its denominator.

EXAMPLES.

39. Reduce $\frac{2}{3}$ to a fraction of the same value, whose numerator shall be 12. As $2 : 3 :: 12 : 18$. *Facit* $\frac{12}{18}$.

40. Reduce $\frac{5}{7}$ to a fraction of the same value, whose numerator shall be 25. *Facit* $\frac{25}{35}$.

41. Reduce $\frac{5}{7}$ to a fraction of the same value, whose numerator shall be 47.

Facit $\frac{47}{65\frac{4}{5}}$

9. To reduce fractions of one denomination to another of the same value, having the denominator given of the fraction required.

RULE. As the denominator of the given fraction: is to its numerator: : so is the denominator of the intended fraction: to its numerator.

EXAMPLES.

42. Reduce $\frac{2}{3}$ to a fraction of the same value, whose denominator shall be 18. As $3 : 2 :: 18 : 12$. *Facit* $\frac{12}{18}$.

43. Reduce $\frac{5}{7}$ to a fraction of the same value, whose denominator shall be 35. *Facit* $\frac{25}{35}$.

44. Reduce $\frac{5}{7}$ to a fraction of the same value, whose denominator shall be $65\frac{4}{5}$.

Facit $\frac{47}{65\frac{4}{5}}$

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10. *To reduce a mixed fraction to a single one.*

RULE. When the numerator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new numerator; then multiply the denominator of the fraction by the denominator of the fractional part for a new denominator.

EXAMPLES.

45. Reduce $36\frac{2}{3}$ to a simple fraction. *Facit* $\frac{110}{144} = \frac{55}{72}$.

48
 $36 \times 3 + 2 = 110$ numerator.
 $48 \times 3 = 144$ denominator.

46. Reduce $23\frac{5}{7}$ to a simple fraction. *Facit* $\frac{166}{133} = \frac{83}{66\frac{1}{2}}$.

38

When the denominator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new denominator; then multiply the numerator of the fraction by the denominator of the fractional part for a new numerator.

EXAMPLES.

47. Reduce $\frac{47}{65\frac{4}{5}}$ to a simple fraction. *Facit* $\frac{235}{329} = \frac{5}{7}$.

48. Reduce $\frac{19}{44\frac{1}{3}}$ to a simple fraction. *Facit* $\frac{57}{32} = \frac{3}{7}$.

11. *To find the proper quantity of a fraction in the known parts of an integer.*

RULE. Multiply the numerator by the common parts of the integer, and divide by the denominator.

EXAMPLES.

49. Reduce $\frac{3}{4}$ of a pound sterling to its proper quantity.
 $3 \times 20 = 60 \div 4 = 15s.$ *Facit* 15s.

50. Reduce $\frac{2}{3}$ of a shilling to its proper quantity.
Facit 4d. 3 qrs. $\frac{1}{3}$.

51. Reduce $\frac{4}{7}$ of a lb. avoirdupoise to its proper quantity.
Facit 9oz. 2 dr. $\frac{2}{7}$.

52. Reduce $\frac{7}{9}$ of an cwt. to its proper quantity.
Facit 3 qrs. 3 lb. 1 oz. 12 cr. $\frac{4}{9}$.

53. Reduce

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53. Reduce $\frac{3}{4}$ of a lb. troy to its proper quantity.
Facit 7 oz. 4 dwt.
54. Reduce $\frac{5}{8}$ of an ell English to its proper quantity.
Facit 2 qrs. 3 nails, $\frac{1}{9}$.
55. Reduce $\frac{4}{5}$ of a mile to its proper quantity.
Facit 6 furl. 16 poles.
56. Reduce $\frac{5}{8}$ of an acre to its proper quantity.
Facit 2 roods, 20 poles.
57. Reduce $\frac{6}{7}$ of an hoghead of wine to its proper quantity.
Facit 54 gallons.
58. Reduce $\frac{3}{5}$ of a barrel of beer to its proper quantity.
Facit 12 gallons.
59. Reduce $\frac{3}{12}$ of a chaldron of coals to its proper quantity.
Facit 15 bushels.
60. Reduce $\frac{3}{5}$ of a month to its proper time.
Facit 2 weeks, 2 days, 19 hours, $\frac{1}{5}$.

12. To reduce any given quantity to the fraction of any greater denomination, retaining the same value.

RULE. Reduce the given quantity to the lowest term mentioned for a numerator, under which set the integral part (reduced to the same term) for a denominator, and it will give the fraction required.

EXAMPLES.

61. Reduce 15s. to the fraction of a pound sterling.
Facit $\frac{15}{20} = \frac{3}{4}$ £.
62. Reduce 4d. 3 qrs. $\frac{1}{5}$ to the fraction of a shilling.
Facit $\frac{2}{5}$.
63. Reduce 9 oz. 2 dr. $\frac{2}{7}$ to the fraction of a lb. avoirdupoise.
Facit $\frac{4}{7}$.
64. Reduce 3 qrs. 3 lb. 1 oz. 12 dr. $\frac{4}{9}$ to the fraction of an cwt.
Facit $\frac{7}{9}$.
65. Reduce 7 oz. 4 dwt. to the fraction of a lb. troy.
Facit $\frac{3}{5}$.
66. Reduce 2 qrs. 3 nails, $\frac{1}{9}$ to the fraction of an English ell.
Facit $\frac{5}{9}$.
67. Reduce 6 furl. 16 poles to the fraction of a mile.
Facit $\frac{4}{5}$.
68. Reduce 2 roods 20 poles to the fraction of an acre.
Facit $\frac{5}{8}$.
69. Reduce 54 gallons to the fraction of a hoghead of wine.
Facit $\frac{6}{7}$.
70. Reduce

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70. Reduce 12 gallons to the fraction of a barrel of beer.

Facit $\frac{1}{3}$.

71. Reduce 15 bushels to the fraction of a chaldron of coals.

Facit $\frac{5}{12}$.

72. Reduce 2 weeks, 2 days, 19 hours, $\frac{1}{5}$ to the fraction of a month.

Facit $\frac{3}{5}$.

ADDITION of VULGAR FRACTIONS.

R U L E.

REDUCE the given fractions to a common denominator, then add all the numerators together, under which place the common denominator.

E X A M P L E S.

1. Add $\frac{2}{3}$ and $\frac{5}{7}$ together. *Facit* $\frac{14}{21} + \frac{15}{21} = \frac{29}{21} = 1\frac{8}{21}$.

2. Add $\frac{3}{4}$, $\frac{2}{7}$ and $\frac{5}{6}$ together. *Facit* $1\frac{14}{28} + \frac{8}{28} + \frac{25}{28} = 1\frac{47}{28}$.

3. Add $\frac{1}{5}$, $4\frac{1}{3}$ and $\frac{2}{3}$ together. *Facit* $4\frac{7}{15}$.

4. Add $7\frac{2}{3}$ and $\frac{2}{5}$ together. *Facit* $8\frac{1}{15}$.

5. Add $\frac{2}{7}$ and $\frac{2}{3}$ of $\frac{3}{4}$ together. *Facit* $\frac{11}{14}$.

6. Add $5\frac{2}{3}$, $6\frac{7}{8}$, and $4\frac{1}{2}$ together. *Facit* $17\frac{1}{24}$.

2. When the fractions are of several denominations, reduce them to their proper quantities, and add as before.

7. Add $\frac{3}{4}$ of a pound to $\frac{5}{6}$ of a shilling. *Facit* 15s. 10d.

8. Add $\frac{1}{2}$ of a penny to $\frac{2}{3}$ of a pound. *Facit* 13s. 4d. $\frac{1}{2}$.

9. Add $\frac{3}{4}$ of a pound troy to $\frac{1}{6}$ of an ounce.

Facit 9oz. 3 dwt. 8 gr.

10. Add $\frac{5}{4}$ of a ton to $\frac{5}{6}$ of a lb.

Facit 16 cwt. 0 qr. 0 lb. 13 oz. 5 dr. $\frac{1}{3}$.

11. Add $\frac{2}{3}$ of a chaldron to $\frac{1}{4}$ of a bushel.

Facit 24 bushel 3 pecks.

12. Add $\frac{1}{6}$ of a yard to $\frac{2}{3}$ of an inch.

Facit 6 inch. 2 bar. c.

SUBTRACTION of VULGAR FRACTIONS.

R U L E.

REDUCE the given fractions to a common denominator, then subtract the less numerator from the greater, and place the remainder over the common denominator.

2. When

ASSISTANT. *Multiplication of Vulgar Fractions.* 105

2. When the lower fraction is greater than the upper, subtract the numerator of the lower fraction from the denominator, and to that difference add the upper numerator, carrying one to the unit's place of the lower whole number.

EXAMPLES.

1. From $\frac{3}{4}$ take $\frac{5}{7}$. $3 \times 7 = 21$. $5 \times 4 = 20$. $21 - 20 = 1$ num.
 $4 \times 7 = 28$ den. - - - Facit $\frac{1}{28}$.
2. From $\frac{5}{6}$ take $\frac{3}{5}$ of $\frac{5}{8}$. - - - Facit $\frac{11}{24}$.
3. From $5\frac{2}{3}$ take $\frac{9}{10}$. - - - Facit $4\frac{23}{30}$.
4. From $\frac{38}{47}$ take $\frac{3}{5}$. - - - Facit $\frac{40}{235}$.
5. From $\frac{19}{20}$ take $\frac{1}{7}$ of $\frac{2}{3}$. - - - Facit $\frac{359}{420}$.
6. From $64\frac{1}{4}$ take $\frac{2}{3}$ of $\frac{3}{4}$. - - - Facit $63\frac{3}{4}$.

3. When the fractions are of several denominations, reduce them to their proper quantities, and subtract as before.

7. From $\frac{3}{4}$ of a pound take $\frac{3}{4}$ of a shilling. Facit 14s. 3d.
8. From $\frac{2}{3}$ of a shilling take $\frac{1}{2}$ of a penny. Facit 7d. $\frac{1}{2}$.
9. From $\frac{1}{4}$ of a lb. troy take $\frac{1}{6}$ of an ounce.
Facit 8 oz. 16 dwts. 16 gra.
10. From $\frac{4}{5}$ of a ton take $\frac{5}{6}$ of a lb.
Facit 15 cwt. 3 qrs. 27 lb. 2 oz. 10 dr. $\frac{2}{3}$.
11. From $\frac{2}{3}$ of a chaldron take $\frac{1}{4}$ of a bushel.
Facit 23 bushel 1 peck.
12. From $\frac{1}{6}$ of a yard take $\frac{2}{3}$ of an inch. Facit 5 in. 1 b. c.

MULTIPLICATION of VULGAR FRACTIONS.

R U L E.

PREPARE the given numbers (if they require it) by the rules of Reduction: then multiply the numerators together for a new numerator, and the denominators for a new denominator.

NOTE. When any number, either whole or mixed, is multiplied by a fraction, the product will be always less than the multiplicand, in the same proportion as the multiplying fraction is less than an unit.

EXAMPLES.

1. Multiply $\frac{3}{4}$ by $\frac{3}{5}$. Fa. $3 \times 3 = 9$ num. $4 \times 5 = 20$ den. $= \frac{9}{20}$.
2. Multiply $\frac{7}{9}$ by $\frac{2}{3}$. - - - Facit $\frac{14}{27}$.
3. Multiply $48\frac{3}{5}$ by $13\frac{5}{6}$. - - - Facit $672\frac{2}{3}$.
4. Multiply

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4. Multiply $430 \frac{6}{10}$ by $18 \frac{3}{7}$. - - Facit $7935 \frac{24}{70}$.
5. Multiply $\frac{16}{21}$ by $\frac{1}{4}$ of $\frac{5}{7}$ of $\frac{4}{3}$. - Facit $\frac{96}{294} = \frac{16}{49}$.
6. Multiply $\frac{9}{10}$ by $\frac{2}{3}$ of $\frac{1}{4}$ of $\frac{3}{6}$. - Facit $\frac{3}{8}$.
7. Multiply $\frac{3}{4}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{1}{3}$. - Facit $\frac{1}{9}$.
8. Multiply $\frac{1}{4}$ of $\frac{3}{8}$ by $\frac{5}{7}$. - Facit $\frac{15}{224}$.
9. Multiply $5 \frac{6}{7}$ by $\frac{5}{6}$. - Facit $4 \frac{37}{42}$.
10. Multiply 24 by $\frac{2}{3}$. - Facit 16.
11. Multiply $\frac{3}{4}$ of 9 by $\frac{7}{8}$. - Facit $\frac{29}{32}$.
12. Multiply $9 \frac{1}{2}$ by $\frac{2}{6}$. - Facit $3 \frac{1}{6}$.

DIVISION of VULGAR FRACTIONS.

R U L E.

PREPARE the given numbers (if they require it) by the rules of Reduction, then multiply the denominator of the divisor into the numerator of the dividend for a new numerator, and the numerator of the divisor into the denominator of the dividend for a new denominator.

NOTE. When any whole number is divided by a fraction less than unity, the quotient will be greater than the dividend: but if any fraction be divided by a whole number greater than unity, the quotient will be less than the dividend.

E X A M P L E S.

1. Divide $\frac{9}{20}$ by $\frac{3}{4}$. $5 \times 9 = 45$ num. $3 \times 20 = 60$ den. $\frac{45}{60} = \frac{3}{4}$.
2. Divide $\frac{14}{27}$ by $\frac{2}{3}$. - - Facit $\frac{7}{9}$.
3. Divide $672 \frac{9}{10}$ by $13 \frac{5}{6}$. - Facit $48 \frac{3}{5}$.
4. Divide $7935 \frac{24}{70}$ by $18 \frac{3}{7}$. - Facit $430 \frac{3}{5}$.
5. Divide $\frac{3}{8}$ by $\frac{2}{3}$ of $\frac{1}{4}$ of $\frac{3}{6}$. - Facit $\frac{9}{160}$.
6. Divide $\frac{2}{3}$ of 16 by $\frac{5}{7}$ of $\frac{3}{4}$. - Facit $19 \frac{41}{45}$.
7. Divide $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{3}{4}$. - Facit $\frac{24}{36} = \frac{2}{3}$.
8. Divide $9 \frac{2}{12}$ by $\frac{1}{2}$ of 7. - Facit $18 \frac{13}{12}$.
9. Divide $\frac{9}{10}$ by $4 \frac{1}{2}$. - Facit $\frac{1}{8}$.
10. Divide 16 by 24. - Facit $\frac{2}{3}$.
11. Divide $5205 \frac{10}{100}$ by $\frac{4}{5}$ of 91. - Facit $71 \frac{1}{2}$.
12. Divide $3 \frac{1}{6}$ by $9 \frac{1}{2}$. - Facit $\frac{1}{3}$.

The SINGLE RULE of THREE INVERSE,
in VULGAR FRACTIONS.

EXAMPLES.

IF 48 men can build a wall in 24 days $\frac{1}{4}$, how many men can do the same in 192 days? *Ans.* 6 men $\frac{48}{768}$.

2. If 25s. $\frac{2}{7}$ will pay for the carriage of an cwt. 145 miles $\frac{1}{4}$, how far may 6 cwt. $\frac{1}{2}$ be carried for the same money? *Ans.* 22 miles $\frac{2}{8}$.

3. If $3\frac{1}{4}$ yard of cloth, that is $1\frac{1}{2}$ yard wide, be sufficient to make a cloak, how much must I have of that sort which is $\frac{4}{5}$ yard wide, to make another of the same bigness?

Ans. $4\frac{7}{8}$ yards.

4. If 3 men can do a piece of work in 4 hours $\frac{1}{2}$, in how many hours will 10 men do the same work? *Ans.* 1 hour $\frac{7}{10}$.

5. If a penny white loaf weigh 7 oz. when a bushel of wheat cost 5s. 6d. what is the bushel worth when the penny white loaf weighs but 2 oz. $\frac{1}{2}$. *Ans.* 15s. 4d. $\frac{4}{5}$.

6. What quantity of shalloon that is $\frac{3}{4}$ yard wide will line $7\frac{1}{2}$ yards of cloth that is $1\frac{1}{2}$ yard wide? *Ans.* 15 yards.

DOUBLE RULE of THREE in
VULGAR FRACTIONS.

EXAMPLES.

IF a carrier receives £2 $\frac{1}{10}$ for the carriage of 3 cwt. 150 miles, how much ought he to receive for the carriage of 7 cwt. 3 qrs. $\frac{1}{2}$ 50 miles? *Ans.* £1..16..9.

2. If £100. in 12 months gain £6. interest, what principal will £3. $\frac{3}{8}$ in 9 months? *Ans.* £75.

3. If 9 students spend £10. $\frac{7}{9}$ in 18 days, how much will 28 students spend in 30 days? *Ans.* £39..18..4 $\frac{360}{1458}$.

4. A man and his wife having laboured one day, earned 4s. $\frac{5}{8}$, how much must they have for 10 days $\frac{1}{2}$, when their two sons helped them? *Ans.* £4..17..1 $\frac{1}{2}$.

5. If £50. in 5 months gain £2. $\frac{37}{144}$, what time will £13. $\frac{1}{3}$ require to gain £1. $\frac{1}{12}$? *Ans.* 9 months.

6. If the carriage of 60 cwt. 20 miles cost £14. $\frac{1}{2}$, what weight can I have carried 30 miles for £5. $\frac{7}{8}$? *Ans.* 15 cwt.

PART III.

From which it plainly appears, that, as whole numbers increase in a ten-fold proportion to the left-hand, decimal parts decrease in a ten-fold proportion to the right-hand:

so that cyphers placed before decimal parts decrease their value, by removing them farther from the comma, or units place; thus, ,5 is 5 parts of 10, or $\frac{5}{10}$; ,05 is 5 parts of 100, or $\frac{5}{100}$; ,005 is 5 parts of 1000, or $\frac{5}{1000}$; ,0005 is 5 parts of 10000, or $\frac{5}{10000}$. But cyphers after decimal parts do not alter their value. For ,5 ,50 ,500, &c. are each but $\frac{5}{10}$ of the unit.

A FINITE DECIMAL is that which ends at a certain number of places; but an INFINITE is that which no where ends.

A RECURRING DECIMAL is that wherein one or more figures are continually repeated, as 2,75222.

And 52,275275275 is called a COMPOUND RECURRING DECIMAL.

NOTE. *A finite decimal may be considered as infinite, by making cyphers to recur; for they do not alter the value of the decimal.*

In all operations, if the result consists of several nines, reject them, and make the next superior place an unit more; thus for 26,25999 write 26,26.

In all circulating numbers, dash the first figure, as in 86,54666.

ADDITION of DECIMALS.

R U L E.

IN setting down the proposed numbers to be added great care must be taken in placing every figure directly underneath those of the same value, whether they be mixed numbers, or pure decimal parts; and to perform which there must be a due regard had to the commas, or separating points, which ought always to stand in a direct line, one under another, and to the right hand of them carefully place the decimal parts, according to their respective values; then add them as in whole numbers.

E X A M P L E S.

1. Add $72,5 + 32,071 + 2,1574 + 371,4 + 2,75$.

Facit 480,8784.

2. Add $30,07 + 2,0071 + 59,4 + 3207,1$.

3. Add $3,5 + 47,25 + 927,01 + 2,0073 + 1,5$.

4. Add $52,75 + 47,21 + 724 + 31,452 + ,3075$.

5. Add $3275 + 27,514 + 1,005 + 725 + 7,32$.

6. Add $27,5 + 52 + 3,2075 + ,5741 + 2720$.

S U B-

SUBTRACTION of DECIMALS.

R U L E.

SUBTRACTION of Decimals differs but little from whole numbers, only in placing the numbers, which must be carefully observed, as in addition.

E X A M P L E S.

- | | |
|----------------------------|---------------------------|
| 1. From ,2754 take ,2371 | 5. From 571 take 54,72 |
| 2. From 2,37 take 1,76 | 6. From 625 take 76,91 |
| 3. From 271 take 215,7 | 7. From 23,415 take ,3742 |
| 4. From 270,2 take 75,4075 | 8. From ,107 take ,0007 |

MULTIPLICATION of DECIMALS.

R U L E.

PLACE the factors, and multiply them as in whole numbers, and from the product towards the right-hand cut off as many places for decimals as there are in both factors together; but if there should not be so many places in the product, supply the defect with cyphers to the left-hand.

E X A M P L E S.

- | | |
|----------------------------|------------------------------|
| 1. Multiply ,2365 by ,2435 | <i>Facit</i> ,05758775. |
| 2. Multiply 2,071 by 2,27 | 7. Multiply 27,35 by 7,70071 |
| 3. Multiply 27,15 by 25,3 | 8. Multiply 5,721 by ,0075 |
| 4. Multiply 79347 by 23,15 | 9. Multiply ,007 by ,007 |
| 5. Multiply 17105 by ,3257 | 10. Multiply 20,15 by ,2705 |
| 6. Multiply 17105 by ,0237 | 11. Multiply ,907 by ,0025 |

When any number of decimals is to be multiplied by 10, 100, 1000, &c. it is only removing the separating point in the multiplicand so many places towards the right-hand as there are cyphers in the multiplier: thus, $,578 \times 10 = 5,78$. $,578 \times 100 = 57,8$. $,578 \times 1000 = 578$. $,578 \times 10000 = 5780$.

Contracted MULTIPLICATION of DECIMALS.

R U L E.

PUT the unit's place of the multiplier under that place of the multiplicand that is intended to be kept in the product; then invert the order of all the other figures, *i. e.* write them all the contrary way; then in multiplying, begin at the figure in the multiplicand, which stands over the figure you are then multiplying with, and set down the first figure of each particular product directly one under the other, and have a due regard to the increase arising from the figures on the right hand of that figure you begin to multiply at in the multiplicand.

Note, That in multiplying the figure left out every time next the right-hand in the multiplicand, if the product be 5, or upwards, to 15, carry 1; if 15, or upwards, to 25, carry 2; and if 25, or upwards, to 35, carry 3, &c.

E X A M P L E S.

12. Multiply 384,672158 by 36,8345, and let there be only four places of decimals in the product.

Contracted Way.

384,672158
5438,63

115401647
23080329
3077377
115402
15387
1923

14169,2065

Facit 14169,2065.

Common Way.

384,672158
36,8345

1923360790
1538688632
1154016474
3077377264
2308032948
1154016474

14169,2066038510

13. Multiply 3,141592 by 52,7438, and leave only 4 places of decimals.

Facit 165,6994.

14. Multiply 2,38645 by 8,2175, and leave only 4 places of decimals.

Facit 19,6107.

15. Multiply 375,13758 by 16,7324, and let there be only 1 place of decimals.

Facit 6276,9.

16. Multiply 375,13758 by 16,7324, and leave only 4 places of decimals.

Facit 6276,9520.

17. Multiply 395,3756 by ,75642, and let there be only 4 places of decimals.

Facit 299,0699.

DIVISION

DIVISION of DECIMALS.

THIS Rule is also worked as in whole numbers: the only difficulty is in valuing the quotient, which is done by any of the following Rules.

RULE 1. The first figure in the quotient is always of the same value with that figure of the dividend, which answers or stands over the place of units in the divisor.

2. The quotient must have always so many decimal places, as the dividend has more than the divisor.

NOTE 1. If the divisor and dividend have both the same number of decimal parts, the quotient will be a whole number.

2. If the dividend hath not so many places of decimals as are in the divisor, then so many cyphers must be annexed to the dividend as will make them equal, and the quotient will then be a whole number.

3. But if, when the division is done, the quotient has not so many figures as it should have places of decimals, then so many cyphers must be prefixed as there are places wanting.

EXAMPLES.

- | | |
|-------------------------------|-------------------------------|
| 1. Divide 85643,825 by 6,321. | <i>Facit</i> 13545. |
| 2. Divide 48 by 144. | 7. Divide 7382,54 by 6,4252. |
| 3. Divide 217,75 by 65. | 8. Divide ,0851648 by 423. |
| 4. Divide 125 by ,1045. | 9. Divide 267,15975 by 13,25. |
| 5. Divide 709 by 2,574. | 10. Divide 72,1564 by ,1347. |
| 6. Divide 5,714 by 8275. | 11. Divide 715 by ,3075. |

When numbers are to be divided by 10, 100, 1000, 10,000, &c. it is performed by placing the separating point in the dividend, so many places towards the left-hand, as there are cyphers in the divisor.

Thus, $5784 \div 10 = 578,4$ $5784 \div 1000 = 5,784.$
 $5784 \div 100 = 57,84$ $5784 \div 10000 = ,5784.$

Contracted DIVISION of DECIMALS.

R U L E.

BY the first rule find what is the value of the first figure in the quotient; then by knowing the first figure's denomination, the decimal places may be reduced to any number, by taking as many of the left-hand figures of the dividend as will answer them; and in dividing omit one figure of the divisor at each following operation.

Note, That in multiplying every figure left out in the divisor, you must carry 1, if it be 5, or upwards to 15; if 15 or upwards, to 25, carry 2; if 25, or upwards, to 35, carry 3, &c.

E X A M P L E S.

12. Divide 721,17562 by 2,257432, and let there be only three places of decimals in the quotient.

<i>Contracted.</i>		<i>Common way.</i>	
2,257432)	721,17562 (319,467	2,257432)	721,17562 (319,467
.....	6772296		6772296
	<hr/>		<hr/>
	439460.		439460 2
	225743.		225743 2
	<hr/>		<hr/>
	213717..		213717 00
	203169..		203168 88
	<hr/>		<hr/>
	10548...		10548 120
	9030...		9029 728
	<hr/>		<hr/>
	1518....		1518 3920
	1354....		1354 4592
	<hr/>		<hr/>
	164.....		163 93280
	158.....		158 02024
	<hr/>		<hr/>
	6		5 91256

13. Divide 8,758615 by 5,2714167.
 14. Divide 51717591 by 8,7586.
 15. Divide, 25,1367 by 217,35.
 16. Divide 51,47549 by 123415.
 17. Divide 70,23 by 7,9863.
 18. Divide 27,104 by 3,712.

REDUCTION

REDUCTION of DECIMALS.

To reduce a Vulgar Fraction to a Decimal.

R U L E.

ADD cyphers to the numerator, and divide by the denominator, the quotient is the decimal fraction required.

E X A M P L E S.

1. Reduce $\frac{1}{4}$ - - - - to a decimal. 4)1,00(25 Facit.
2. Reduce $\frac{1}{2}$ - - - - to a decimal. Facit ,5.
3. Reduce $\frac{3}{4}$ - - - - to a decimal. Facit ,75.
4. Reduce $\frac{3}{8}$ - - - - to a decimal. Facit ,375.
5. Reduce $\frac{5}{26}$ - - - - to a decimal. Facit ,1923076+.
6. Reduce $\frac{1}{14}$ of $\frac{10}{13}$ - to a decimal. Facit ,6043956+.

Note, If the given parts are of several denominations, they may be reduced either by so many distinct operations, as there are different parts, or by first reducing them into their lowest denomination, and then divide as before; or,

2dly, Bring the lowest into decimals of the next superior denomination, and on the right-hand of the decimal found, place the parts given of the next superior denomination; so proceeding till you bring out the decimal parts of the highest integer required, by still dividing the product by the next superior denominator; or,

3dly, To reduce shillings, pence, and farthings. If the number of shillings be even, take half for the first place of decimals, and let the second and third places be filled up with the farthings contained in the remaining pence and farthings, always remembering to add 1, when it is or exceeds 25. But if the number of shillings be odd, the second place of decimals must be increased by 5.

7. Reduce 5s. to the decimal of a £. Facit ,25.
8. Reduce 9s. to the decimal of a £. Facit ,45.
9. Reduce 16s. to the decimal of a £. Facit ,8.

10. Reduce

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10. Reduce 8s. 4d. to the decimal of a £. *Facit* ,4166.

11. Reduce 16s. 7d. $\frac{3}{4}$ to the decimal of a £.

Facit ,8322916.

<i>first.</i>	<i>second.</i>	<i>third.</i>	
16s. 7d. $\frac{3}{4}$	4)3,00	2)16	7 $\frac{3}{4}$
12			4
<hr/>	12)7,75	<hr/>	<hr/>
199		,832	32
4	210)16,64583		
<hr/>	<hr/>		

960)799(,8322916 ,8322916

12. Reduce 19s. 5d. $\frac{1}{2}$ to the decimal of a £.

Facit ,972916.

13. Reduce 12 grains to the decimal of a lb. troy.

Facit ,002083.

14. Reduce 12 drams to the decimal of a lb. avoirdupoise.

Facit ,046875.

15. Reduce 2 qrs. 14 lb. to the decimal of an cwt.

Facit ,625.

16. Reduce 2 furlongs to the decimal of a league.

Facit ,0833.

17. Reduce 2 quarts, 1 pint, to the decimal of a gallon.

Facit ,625.

18. Reduce 4 gallons, 2 quarts of wine, to the decimal of an hogshead.

Facit ,071428+.

19. Reduce 2 gallons, 1 quart of beer, to the decimal of a barrel.

Facit ,0625.

20. Reduce 52 days to the decimal of a year.

Facit ,142465+.

To find the value of any Decimal Fraction, in the known parts of an Integer.

RULE. Multiply the decimal given, by the number of parts of the next inferior denomination, cutting off the decimals from the product; then multiply the remainder by the next inferior denomination; thus proceeding, till you have brought in the least known parts of an integer.

EXAMPLES.

21. What is the value of ,8322916 of a £. *Ans.* 16s. 7d. $\frac{1}{2}$ +.

$$\begin{array}{r}
 \\
 \\
 \hline
 16,6458320 \\
 12 \\
 \hline
 7,7499840 \\
 4 \\
 \hline
 \frac{1}{2},9999360
 \end{array}$$

22. What is the value of ,002084 of a lb. troy?
Ans. 12,00384 qrs.
 23. What is the value of ,046875 of a lb. Avoirdupoise?
Ans. 12 drams.
 24. What is the value of ,625 of an cwt.?
Ans. 2 qrs. 14 lb.
 25. What is the value of ,625 of a gallon?
Ans. 2 quarts 1 pint.
 26. What is the value of ,071428 of a hoghead of wine?
Ans. 4 gallons, 1 quart, ,999856.
 27. What is the value of ,0625 of a barrel of beer?
Ans. 2 gallons 1 quart.
 28. What is the value of ,142465 of a year?
Ans. 51,999725 days.

Decimal TABLES of COIN, WEIGHT, and MEASURE.

TABLE I.
ENGLISH COIN.
£1 the Integer.

<i>Sh.</i>	<i>dec.</i>	<i>Sh.</i>	<i>dec.</i>
19	,95	9	,45
18	,9	8	,4
17	,85	7	,35
16	,8	6	,3
15	,75	5	,25
14	,7	4	,2
13	,65	3	,15
12	,6	2	,1
11	,55	1	,05
10	,5		

<i>Pence.</i>	<i>Decimals.</i>
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,00416

<i>Farthings.</i>	<i>Decimals.</i>
3	,003125
2	,0020833
1	,0010416

TABLE II.
ENG. COIN. 1 *Sh.*
Long Meas. 1 *Foot*
the Integer.

<i>Pence and Inches.</i>	<i>Decimlas.</i>
6	,5
5	,416666
4	,333333
3	,25
2	,166666
1	,083333

<i>Farthings.</i>	<i>Decimals.</i>
3	,0625
2	,041666
1	,020833

TABLE III.
TROY WEIGHT.
1 lb. the Integer.
Ounces the same as Pence in the last Table.

<i>Penny-weight.</i>	<i>Decimals.</i>
10	,041666
9	,0375
8	,033333
7	,029166
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

<i>Grains.</i>	<i>Decimals.</i>
12	,002083
11	,001910
10	,001736
9	,001562
8	,001389
7	,001215
6	,001042
5	,000868
4	,000694
3	,000521
2	,000347
1	,000173

1 Oz. the Integer.

Penny-weights the same as Shillings in the first Table.

<i>Grains.</i>	<i>Decimals.</i>
12	,025
11	,022916
10	,020833
9	,01875
8	,016666
7	,014583
6	,0125
5	,010416
4	,008333
3	,00625
2	,004166
1	,002083

TABLE IV.
AVOIRDUP. WT.
112 lb. the Integer.

<i>Qrs.</i>	<i>Decimals.</i>
3	,75
2	,5
1	,25

<i>Pounds.</i>	<i>Decimals.</i>
14	,125
13	,116071
12	,107143
11	,098114
10	,089286
9	,080357
8	,071428
7	,0625
6	,053571
5	,044643
4	,035714
3	,026786
2	,017857
1	,008928

<i>Ounces.</i>	<i>Decimals.</i>
8	,004464
7	,003906

Decimal Tables of COIN, WEIGHT, and MEASURE.

6	,003348	80	,317460	Pints.	Decimals
5	,002790	70	27	3	,005952
4	,002232	60	,238095	2	,003968
3	,001674	50	,198412	1	,001984
2	,001116	40	,158730	TABLE VII. MEASURE. Liquid. Dry. 1 Gallon, 1 Quarter. Integer.	
1	,000558	30	,119047		
$\frac{1}{4}$ Oz.	Decimals	20	,079365		
3	,000418	10	,039682		
2	,000279	9	,035714	Pints.	Decim.
1	,000139	8	,031746	4	,5
TABLE V. AVOIRDUP. WT. 1 lb. the Integer.		7	,027	3	,375
		6	,023809	2	,25
		5	,019841	1	,125
		4	,015873	1	,125
Ounces.	Decimals	3	,011904	2	,25
8	,5	2	,007936	1	,125
7	,4375	1	,003968	2. pt.	Decim.
6	,375	Pints.	Decimals	3	,09375
5	,3125	4	,001984	2	,0625
4	,25	3	,001488	1	,03125
3	,1875	2	,000992	Decimals.	2. Pks.
2	,125	1	,000496	,0234375	3
1	,0625	A Hoghead the Integer.		,015625	2
Drams.	Decimals			,0078125	1
8	,03125			Decimals.	Pints.
7	,027343	Gallons.	Decimals	,005859	3
6	,023437	30	,476190	,003906	2
5	,019531	20	,317460	,001953	1
4	,015625	10	,158730	TABLE VIII. LONG MEASURE. 1 Mile the Integer.	
3	,011718	9	,142857		
2	,007812	8	,126984		
1	,003906	7	,111111		
TABLE VI. LIQUID MEAS. 1 Tun the Integer.		6	,095238	Yards.	Decimals
		5	,079365	1000	,568182
		4	,063492	900	,511364
		3	,047619	800	,454545
Gallons.	Decimals	2	,031746	700	,397727
100	,396825	1	,015873	600	,340909
90	,357141				

Decimal TABLES of COIN, WEIGHT, and MEASURE.

500	,284091	80	,219178	TABLE X.	
400	,227272	70	,191781	CLOTH MEASURE.	
300	,170454	60	,164383	1 Yard the Integer.	
200	,113636	50	,136986	<i>Qrs. the same as</i>	
100	,056818	40	,109589	Table 4.	
90	,051136	30	,082192		
80	,045454	20	,054794	<i>Nails.</i>	<i>Decimals</i>
70	,039773	10	,027397	2	,125
60	,034091	9	,024657	1	,0625
50	,028409	8	,021918		
40	,022727	7	,019178	TABLE XI.	
30	,017045	6	,016438	LEAD WEIGHT.	
20	,011364	5	,013698	A Fother the Integer.	
10	,005682	4	,010959		
9	,005114	3	,008219	<i>Hund.</i>	<i>Decimals.</i>
8	,004545	2	,005479	10	,512820
7	,003977	1	,002739	9	,461538
6	,003409	1 Day the Integer.		8	,410256
5	,002841	<i>Hours.</i>	<i>Decimals</i>	7	,358974
4	,002273	12	,5	6	,307692
3	,001704	11	,458333	5	,256410
2	,001136	10	,416666	4	,205128
1	,000568	9	,375	3	,153840
		8	,333333	2	,102564
<i>Feet.</i>	<i>Decimals.</i>	7	,291666	1	,051282
2	,0003787	6	,25		
1	,0001894	5	,208333	<i>Qrs.</i>	<i>Decimals.</i>
		4	,166666	2	,025641
<i>Inches.</i>	<i>Decimals.</i>	3	,125	1	,012820
6	,0000947	2	,083333		
3	,0000474	1	,041666	<i>Pounds.</i>	<i>Decimals</i>
1	,0000158			14	,0064102
TABLE IX.		<i>Minutes.</i>	<i>Decimals</i>	13	,0059523
TIME.		30	,020833	12	,0054945
1 Year the Integer.		20	,013888	11	,0050366
<i>Months the same as</i>		10	,006944	10	,0045787
<i>Pence in the second</i>		9	,00625	9	,0041208
<i>Table.</i>		8	,005555	8	,0036630
		7	,004861	7	,0032051
<i>Days.</i>	<i>Decimals.</i>	6	,004166	6	,0027472
365	1,000000	5	,003472	5	,0022893
300	,821918	4	,002777	4	,0018315
200	,547945	3	,002083	3	,0013736
100	,273973	2	,001388	2	,0009157
90	,246575	1	,000694	1	,0004578

The RULE of THREE in DECIMALS.

EXAMPLES.

IF $26 \frac{1}{2}$ yards cost £3..16..3. what will $32 \frac{1}{4}$ yards come to? *Ans.* £4..12..9 $\frac{1}{2}$.

Rds. *£.* *Rds.*
26,5 : 3,8125 : : 32,25 :

32,25
26,5)122,953125(4,63974=£4..12..9 $\frac{1}{2}$.

2. What will the pay of 540 men come to at £1..5..6, per man? *Ans.* £688..10..-

3. If $7 \frac{1}{4}$ yards of cloth cost £2..12..9. what will $140 \frac{1}{2}$ yards of the same cost? *Ans.* £ 47..16..3..2,4 qrs.

4. If a chest of sugar, weighing 7 cwt. 2 qrs. 14 lb. cost £36..12..9. what will 2 cwt. 1 qr. 21 lb. of the same cost? *Ans.* £11..14..2..3,5 qrs.

5. A grocer buys 24 ton, 12 cwt. 2 qrs. 14 lb. 12 oz. of tobacco for £3678..6..4. what will 1 oz. come to? *Ans.* 1d.

6. What will 326 lb. 1 qr. of tobacco come to, when 1 lb. $\frac{1}{2}$ is sold for 3s. 6d. *Ans.* £38..1..3.

7. What is the worth of 19 oz. 3 dwt. 5 gr. of gold, at £2..19..-. per oz.? *Ans.* £56..10..5..2,99 qrs.

8. What is the worth of $827 \frac{1}{4}$ yards of painting, at 10d. $\frac{1}{2}$ per yard? *Ans.* £ 36..4..3. 1,5 qrs.

9. If I lent my friend £34. for $\frac{5}{8}$ of a year, how much ought he to lend me $\frac{5}{12}$ of a year to requite my kindness? *Ans.* £51.

10. If $\frac{3}{4}$ of a yard of cloth, that is 2 yards $\frac{1}{4}$ broad, make a garment, how much that is $\frac{4}{5}$ of a yard wide will make the same? *Ans.* 2,109375 yards.

11. If one ounce of silver cost 5s. 6d. what is the price of a tankard that weighs 1 lb. 10 oz. 10 dwt. 4 grs.? *Ans.* £6..3..9..2,2 qrs.:

12. If 1 lb. of tobacco cost 15d. what cost 3 hogheads, weighing together 15 cwt. 1 qr. 19 lb.? *Ans.* £107..18..9.

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13. If 1 cwt. of currants cost £2..9..6. what will 45 cwt. 3 qrs. 14lb. cost at the same rate? *Ans.* £113..10..9. 3 qrs.

14. Bought 6 chests of sugar, each 6 cwt. 3 qrs. at £2..16..-. per cwt. what do they come to? *Ans.* £113..8..-.

15. Bought a tankard for £10..12..-. at the rate of 5s. 4d. per ounce, what was the weight? *Ans.* 39 oz. 15 dwt.

16. Gave £187..3..3. for 25 cwt. 3 qrs. 14 lb. of tobacco, at what rate did I buy it at per lb.? *Ans.* 15d. 2 qrs.

17. Bought 29 lb. 4 oz. of coffee for £10..11..3. what is the value of 3 lb.? *Ans.* £1..1..8.

18. If I gave 1s. 1d. for 3 lb. $\frac{1}{2}$ of cheese, what will be the value of 1 cwt.? *Ans.* £1..14..8.

EXTRACTION of the SQUARE ROOT.

EXTRACTING the Square Root is to find out such a number as being multiplied into itself, the product will be equal to the given number.

RULE. *First*, Point the given number, beginning at the unit's place, then to the hundreds, and so upon every second figure throughout.

Secondly, Seek the greatest square number in the first point towards the left-hand, placing the square number under the first point, and the root thereof in the quotient; subtract the square number from the first point, and to the remainder bring down the next point, and call that the Resolvend.

Thirdly, Double the quotient, and place it for a divisor on the left-hand of the resolvend; seek how often the divisor is contained in the resolvend (preserving always the unit's place), and put the answer in the quotient, and also on the right-hand side of the divisor; then multiply by the figure last put in the quotient, and subtract the product from the resolvend; bring down the next point to the remainder (if there be any more) and proceed as before.

ROOTS,	1.	2.	3.	4.	5.	6.	7.	8.	9.
SQUARES,	1.	4.	9.	16.	25.	36.	49.	64.	81.

EXAMPLES.

EXAMPLES.

1. What is the square root of 119025? *Ans.* 345.

$$\begin{array}{r}
 119025(345 \\
 \underline{9} \\
 64)290 \\
 \underline{256} \\
 685)3425 \\
 \underline{3425}
 \end{array}$$

2. What is the square root of 106929? *Ans.* 327.
 3. What is the square root of 2263741? *Ans.* 1506,23+.
 4. What is the square root of 7596796? *Ans.* 2756,228+.
 5. What is the square root of 36372961? *Ans.* 6031.
 6. What is the square root of 22071204? *Ans.* 4698.

When the given number consists of a whole number, and decimals together, make the number of decimals even, by adding cyphers to them; so that there may be a point fall on the unit's place of the whole number.

7. What is the square root of 3271,4207? *Ans.* 57,19+.
 8. What is the square root of 4795,25731? *Ans.* 69,247+.
 9. What is the square root of 4,372594? *Ans.* 2,091+.
 10. What is the square root of 2,2710957? *Ans.* 1,50701+.
 11. What is the square root of ,00032754? *Ans.* ,01809+.
 12. What is the square root of 1,270054? *Ans.* 1,1269+.

To extract the Square Root of a VULGAR FRACTION.

RULE. Reduce the fraction to its lowest terms: then extract the square root of the numerator for a new numerator, and the square root of the denominator for a new denominator.

If the fraction be a surd (i. e.) a number where a root can never be exactly found, reduce it to a decimal, and extract the root from it.

EXAMPLES.

13. What is the square root of $\frac{2304}{5184}$? *Ans.* $\frac{2}{3}$.
 14. What is the square root of $\frac{2704}{4225}$? *Ans.* $\frac{4}{5}$.
 15. What is the square root of $\frac{9216}{12344}$? *Ans.* $\frac{6}{7}$.

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S U R D S.

16. What is the square root of $\frac{275}{340}$? *Ans.* ,89934 +.
 17. What is the square root of $\frac{357}{476}$? *Ans.* ,86602 +.
 18. What is the square root of $\frac{478}{549}$? *Ans.* ,93308 +.

To extract the Square Root of a MIXED NUMBER.

RULE. Reduce the fractional part of the mixed number to its lowest term, and then the mixed number to an improper fraction.

2. Extract the roots of the numerator and denominator for a new numerator and denominator.

If the mixed number given be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the square root therefrom.

E X A M P L E S.

19. What is the square root of $51\frac{2}{3}$? *Ans.* $7\frac{1}{3}$.
 20. What is the square root of $27\frac{9}{16}$? *Ans.* $5\frac{1}{4}$.
 21. What is the square root of $9\frac{4}{9}$? *Ans.* $3\frac{1}{3}$.

S U R D S.

22. What is the square root of $85\frac{1}{3}$? *Ans.* 9,27 +.
 23. What is the square root of $8\frac{5}{7}$? *Ans.* 2,9519 +.
 24. What is the square root of $6\frac{2}{3}$? *Ans.* 2,5819 +.

The APPLICATION.

1. There is an army consisting of a certain number of men, who are placed rank and file (that is, in the form of a square, each side having 576 men) I desire to know how many the whole square contains? *Ans.* 331776.

2. A certain pavement is made exactly square, each side of which contains 97 feet. I demand how many square feet are contained therein? *Ans.* 9409.

To find a mean proportional between any two given numbers.

RULE. The square root of the product of the given number is the mean proportional sought.

E X A M P L E S.

EXAMPLES.

27. What is the mean proportional between 3 and 12?

Ans. $3 \times 12 = 36$ then $\sqrt{36} = 6$ the mean proportional.

28. What is the mean proportional between 4276 and 842?

Ans. 1897,4+.

To find the side of a square equal in area to any given superficies.

RULE. The square root of the content of any given superficies is the square equal sought.

EXAMPLES.

29. If the content of a given circle be 160, what is the side of the square?

Ans. 12,64911.

30. If the area of a circle is 750, what is the side of the square equal?

Ans. 27,38612.

The area of a circle given, to find the diameter.

RULE. As 355 : 452, or, as 1 : 1,273239 :: so is the area : to the square of the diameter:—or, multiply the square root of the area, by 1,12837, and the product will be the diameter.

EXAMPLES.

31. What length of cord will be fit to tie to a cow's tail, the other end fixed in the ground, to let her have liberty of eating an acre of grass, and no more, supposing the cow and tail to be 5 yards $\frac{1}{2}$?

Ans. 6,136 perches

The area of a circle given, to find the periphery, or circumference.

RULE. As 113 : 1420, or, as 1 : 12,56637 :: the area to the square of the periphery:—or, multiply the square root of the area by 3,5449, and the product is the circumference.

EXAMPLES.

32. When the area is 12, what is the circumference?

Ans. 12,2795.

33. When the area is 160, what is the periphery?

Ans. 44,839.

Any two sides of a right angled triangle given, to find the third side.

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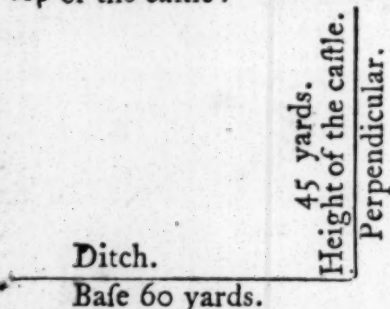
1. *The base and perpendicular given, to find the hypotenuse.*

RULE. The square root of the sum of the squares of the base and perpendicular is the length of the hypotenuse.

EXAMPLES.

34. The top of a castle from the ground is 45 yards high, and surrounded with a ditch 60 yards broad; what length must a ladder be to reach from the outside of the ditch to the top of the castle?

Ans. 75 yards.



35. The wall of a town is 25 feet high, which is surrounded by a moat of 30 feet in breadth: I desire to know the length of a ladder that will reach from the outside of the moat to the top of the wall.

Ans. 39,05 feet.

The hypotenuse and perpendicular given, to find the base.

RULE. The square root of the difference of the squares of the hypotenuse and perpendicular is the length of the base.

The base and hypotenuse given, to find the perpendicular.

RULE. The square root of the difference of the squares of the hypotenuse and base is the height of the perpendicular.

N. B. *The two last questions may be varied for examples to the two last propositions.*

Any number of men being given to form them into a square battle, or to find the number of ranks and files.

RULE. The square root of the number of men given, is the number of men either in rank or file.

36. An army consisting of 331776 men, I desire to know how many rank and file?

Ans. 576.

37. A certain square pavement contains 48841 square stones, all of the same size, I demand how many are contained in one of the sides?

Ans. 221.

EXTRACTION

EXTRACTION of the CUBE ROOT.

TO extract the Cube Root is to find out a number, which being multiplied into itself, and then into that product, produceth the given number.

RULE 1. Point every third figure of the cube given, beginning at the unit's place; seek the greatest cube to the first point, and subtract it therefrom; put the root in the quotient, and bring down the figures in the next point to the remainder for a **RESOLVEND**.

2. Find a **DIVISOR** by multiplying the square of the quotient by 3. See how often it is contained in the resolvend, rejecting the units and tens, and put the answer in the quotient.

3. To find the **SUBTRAHEND**. 1. Cube the last figure in the quotient. 2. Multiply all the figures in the quotient by 3, except the last, and that product by the square of the last. 3. Multiply the divisor by the last figure. Add these products together, gives the subtrahend, which subtract from the resolvend; to the remainder bring down the next point, and proceed as before.

ROOTS. 1. 2. 3. 4. 5. 6. 7. 8. 9.

CUBES. 1. 8. 27. 64. 125. 216. 343. 512. 729.

EXAMPLES.

1. What is the cube root of 99252847?

$$\begin{array}{r} 99252847. (463 \\ 64 = \text{cube of } 4. \end{array}$$

Divisor. _____

Square of 4 \times 3 = 48) 35252 resolvend.

$$216 = \text{cube of } 6.$$

$$432 = 4 \times 3 \times \text{by square of } 6.$$

$$288 = \text{divisor} \times \text{by } 6$$

$$33336 \text{ subtrahend.}$$

Divisor. _____

Square of 46 \times 3 = 6348) 1916847 resolvend.

$$27 = \text{cube of } 3.$$

$$1242 = 46 \times 3 \times \text{by square of } 3.$$

$$19044 = \text{divisor} \times \text{by } 3.$$

$$1916847 \text{ subtrahend.}$$

Another

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Another New and more Concise Method of extracting the CUBE ROOT.

RULE 1. Point every third figure of the cube given, beginning at the unit's place, then find the highest cube to the first point, and subtract it therefrom, put the root in the quotient, bring down the figures in the next point to the remainder for a resolvend.

2. Square the quotient and triple the square for a divisor, *As* $4 \times 4 \times 3 = 48$. Find how often it is contained in the resolvend, rejecting units and tens, and put the answer in the quotient.

3. Square the last figure in the quotient, and put it on the right-hand of the divisor.

As $6 \times 6 = 36$ put to the divisor $48 = 4836$.

4. Triple the last figure in the quotient and multiply by the former, put it under the other, units under the tens, add them together, and multiply the sum by the last figure in the quotient, subtract that product from the resolvend, bring down the next point, and proceed as before.

EXAMPLES.

1. What is the cube root of 99252847?

Square of $4 \times 3 = 48$ *divisor.*

Square of 6 put to 48 = 4836

$$6 \times 3 \times 4 = 72$$

$$5556 \times 6 =$$

Square of 46 = 2116 $\times 3 = 6348$ *divisor.*

Square of 3 = 9 put to 6348 = *634809

$$3 \times 3 \times 46 = 414$$

$$\begin{array}{r} 99252847(463 \\ 64 \end{array}$$

$$\begin{array}{r} 35252 \\ 33336 \end{array}$$

$$1916847$$

$$638949 \times 3 = 1916847.$$

2. What is the cube root of 389017?

Ans. 73.

3. What is the cube root of 5735339?

Ans. 179.

4. What is the cube root of 32401759?

Ans. 319.

5. What is the cube root of 84604519?

Ans. 439.

6. What is the cube root of 259694072?

Ans. 638.

7. What is the cube root of 48228544?

Ans. 364.

* When the quotient is 2 or 3, there must be a cypher put to supply the place of tens.

8. What

8. What is the cube root of 27054036008? *Ans.* 3002.
9. What is the cube root of 22069810125? *Ans.* 2805.
10. What is the cube root of 122615327232? *Ans.* 4968.
11. What is the cube root of 219365327791? *Ans.* 6031.
12. What is the cube root of 673373097125? *Ans.* 8765.

When the given number consists of a whole number and decimal together, make the number of decimals consist of 3, 6, 9, &c. places by adding cyphers thereto, so that there may be a point fall on the unit's place of the whole number.

13. What is the cube root of 12,977875? *Ans.* 2,35.
14. What is the cube root of 36155,027576? *Ans.* 33,06+.
15. What is the cube root of ,001906624? *Ans.* ,124.
16. What is the cube root of 33,230979637? *Ans.* 3,215+.
17. What is the cube root of 15926,972504? *Ans.* 25,16+.
18. What is the cube root of ,053157376? *Ans.* ,376.

To extract the cube root of a vulgar fraction.

RULE. Reduce the fraction to its lowest terms, then extract the cube root of the numerator and denominator, for a new numerator and denominator; but if the fraction be a furd, reduce it to a decimal, and then extract the root from it.

EXAMPLES.

19. What is the cube root of $\frac{250}{686}$? *Ans.* $\frac{5}{7}$.
20. What is the cube root of $\frac{324}{1568}$? *Ans.* $\frac{3}{5}$.
21. What is the cube root of $\frac{1520}{5130}$? *Ans.* $\frac{2}{3}$.

SURDS.

22. What is the cube root of $\frac{4}{7}$? *Ans.* ,829+.
23. What is the cube root of $\frac{5}{9}$? *Ans.* ,822+.
24. What is the cube root of $\frac{2}{3}$? *Ans.* ,873+.

To extract the cube of a mixed number.

RULE. Reduce the fractional part to its lowest terms, and then the mixed number to an improper fraction, extract the cube roots of the numerator and denominator for a new numerator and denominator; but, if the mixed number given be a furd, reduce the fractional part to decimals, annex it to the whole number, and extract the root therefrom.

EXAMPLES.

EXAMPLES.

25. What is the cube root of $12\frac{19}{27}$? *Ans.* $2\frac{1}{3}$.
 26. What is the cube root of $31\frac{15}{343}$? *Ans.* $3\frac{1}{7}$.
 27. What is the cube root of $405\frac{26}{125}$? *Ans.* $7\frac{2}{5}$.

SURDS.

28. What is the cube root of $7\frac{1}{3}$? *Ans.* $1,93 +$
 29. What is the cube root of $9\frac{1}{6}$? *Ans.* $2,092 +$
 30. What is the cube root of $8\frac{1}{2}$? *Ans.* $2,057 +$

The APPLICATION.

1. If a cubical piece of timber be 47 inches long, 47 inches broad, and 47 inches deep, how many cubical inches doth it contain? *Ans.* 103823.

2. There is a cellar dug, that is 12 feet every way, in length, breadth, and depth, how many solid feet of earth was taken out of it? *Ans.* 1728.

3. There is a stone of a cubic form, which contains 389017 solid feet, what is the superficial content of one of its sides? *Ans.* 5329.

Between two numbers given, to find two mean proportionals.

RULE. Divide the greater extreme by the less, and the cube root of the quotient multiplied by the less extreme gives the less mean; multiply the said cube root by the less mean, and the product will be the greater mean proportional.

EXAMPLES.

4. What are the two mean proportionals between 6 and 162? *Ans.* 18 and 54.
 5. What are the two mean proportionals between 4 and 108? *Ans.* 12 and 36.

To find the side of a cube that shall be equal in solidity to any given solid, as a globe, cylinder, prism, cone, &c.

RULE. The cube root of the solid content of any solid body given, is the side of the cube of equal solidity.

EXAMPLES.

6. If the solid content of a globe is 10648, what is the side of a cube of equal solidity? *Ans.* 22.

The

The side of the cube being given, to find the side of the cube that shall be double, treble, &c. in quantity to the cube given.

RULE. Cube the side given, and multiply it by 2, 3, &c. the cube root of the product is the side sought.

EXAMPLE.

7. There is a cubical vessel, whose side is 12 inches, and it is required to find the side of another vessel, that is to contain 3 times as much? *Ans.* 17,306.

EXTRACTING *of the* BIQUADRATE ROOT.

TO extract the Biquadrate Root is to find out a number, which, being involved four times into itself, will produce the given number.

RULE. First extract the square root of the given number, and then extract the square root of that square root, and it will give the biquadrate root required.

EXAMPLES.

1. What is the biquadrate of 27? *Ans.* 531441.
2. What is the biquadrate of 76? *Ans.* 33362176.
3. What is the biquadrate of 275? *Ans.* 5719140625.
4. What is the biquadrate root of 531441? *Ans.* 27.
5. What is the biquadrate root of 33362176? *Ans.* 76.
6. What is the biquadrate root of 5719140625? *Ans.* 275.

A general RULE for EXTRACTING the ROOTS *of all* POWERS.

1. **P**REPARE the number given for extraction, by pointing off from the unit's place as the root required directs.
2. Find the first figure in the root by the table of powers, which subtract from the given number.
3. Bring down the first figure in the next point to the remainder, and call it the Dividend.
4. Involve the root into the next inferior power to that which is given, multiply it by the given power, and call it the Divisor.

5. Find

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5. Find a quotient figure by common division, and annex it to the root; then involve the whole root into the given power, and call that the Subtrahend.

6. Subtract that number from as many points of the given power as are brought down, beginning at the lowest place, and to the remainder bring down the first figure of the next point for a new dividend.

7. Find a new divisor, and proceed in all respects as before.

EXAMPLES.

1. What is the square root of 141376?

$$\begin{array}{r}
 \dot{1}4\dot{1}3\dot{7}6(376 \\
 \underline{9} \\
 6)51 \text{ dividend.} \\
 \underline{36} \\
 1369 \text{ subtrahend.}
 \end{array}
 \qquad
 \begin{array}{rcl}
 3 \times & 2 & = 6 \text{ divisor.} \\
 37 \times & 37 & = 1369 \text{ subtrahend.} \\
 37 \times & 2 & = 74 \text{ divisor.} \\
 376 \times & 376 & = 141376 \text{ subtrahend.}
 \end{array}$$

74) 447 dividend.

141376 subtrahend.

2. What is the cube root of 53157376?

$$\begin{array}{r}
 \dot{5}3\dot{1}5\dot{7}3\dot{7}6(376 \\
 \underline{27} \\
 27)261 \text{ dividend.} \\
 \underline{50653} \\
 50653 \text{ subtrahend.} \\
 4107)25043 \text{ dividend.} \\
 \underline{53157376} \\
 53157376 \text{ subtrahend.}
 \end{array}$$

$$\begin{array}{rcl}
 3 \times & 3 \times & 3 = 27 \text{ divisor.} \\
 37 \times & 37 \times & 37 = 50653 \text{ subtrahend.} \\
 37 \times & 37 \times & 3 = 4107 \text{ divisor.} \\
 376 \times & 376 \times & 376 = 53157376 \text{ subtrahend.}
 \end{array}$$

3. What

3. What is the biquadrate root of 19987173376?

$$\begin{array}{r} 19987173376(376 \\ 81 \end{array}$$

108)1188 *dividend.*

1874161 *subtrahend.*

202612)1245563 *dividend.*

19987173376 *subtrahend.*

$$\begin{array}{llll} 3 \times & 3 \times & 3 \times & 4 = 108 \text{ divisor.} \\ 37 \times & 37 \times & 37 \times & 37 = 1874161 \text{ subtrahend.} \\ 37 \times & 37 \times & 37 \times & 4 = 202612 \text{ divisor.} \\ 376 \times & 376 \times & 376 \times & 376 = 19987173376 \text{ subtrahend.} \end{array}$$

SIMPLE INTEREST.

THERE are five letters to be observed in Simple Interest, *viz.*

P. the Principal.

T. the Time.

R. the Ratio, or rate *per cent.*

I. the Interest.

A. the Amount.

A TABLE OF RATIO'S.

3	,03	$5\frac{1}{2}$	,055	8	,08
$3\frac{1}{2}$	,035	6	,06	$8\frac{1}{2}$	,085
4	,04	$6\frac{1}{2}$	,065	9	,09
$4\frac{1}{2}$	,045	7	,07	$9\frac{1}{2}$	,095
5	,05	$7\frac{1}{2}$	,075	10	,1

Note. The Ratio is the Simple Interest of £1. for one year, at the Rate per Cent. proposed, and is found thus:

£. £. £.

As 100 : 3 :: 1 : ,03.

As 100 : 3,5 :: 1 : ,035.

When the principal, time, and rate per cent. are given, to find the interest,

RULE. Multiply the principal, time and rate together, and it will give the interest required.

Note. The proposition and rule are better expressed thus:

I. *When P, T, R, are given, to find I.*

Rule. $\text{prt} = \text{I}.$

Note, When two or more letters are put together like a word, they are to be multiplied one into another.

EXAMPLES.

1. What is the interest of £945..10..-. for three years, at 5 per cent. per annum?

Ans. £945.5 \times .05 \times 3 = 141.825 or £141..16..6.

2. What is the interest of £547..14..-. at 4 per cent. per annum, for 6 years?

Ans. £131..8..11. 2 qr. .08.

3. What is the interest of £796..15..-. at $4\frac{1}{2}$ per cent. per annum, for 5 years?

Ans. £179..5..4. 2 qr.

4. What is the interest of £397..9..5. for two years and $\frac{1}{2}$ at $3\frac{1}{2}$ per cent. per annum?

Ans. £34..15..6. 3,5472 qr.

5. What is the interest of £554..17..6. for 3 years, 8 months, at $4\frac{1}{2}$ per cent. per annum?

Ans. £91..11..1—20.

6. What is the interest of £236..18..8. for 3 years, 8 months, at $5\frac{1}{2}$ per cent. per annum?

Ans. £47..15..7. 1,4528 qr.

When the interest is for any number of days only.

RULE. Multiply the interest of £1. for 1 day, at the given rate, by the principal and number of days, it will give the answer.

INTEREST OF £1. FOR ONE DAY.

<i>per cent.</i>	<i>Decimals.</i>	<i>per cent.</i>	<i>Decimals.</i>
3	,00008219178	$6\frac{1}{2}$	,00017808219
$3\frac{1}{2}$	,00009589041	7	,00019178082
4	,00010958904	$7\frac{1}{2}$	,00020547945
$4\frac{1}{2}$	,00012328767	8	,00021917808
5	,00013698630	$8\frac{1}{2}$	,00023287671
$5\frac{1}{2}$	,00015068493	9	,00024657534
6	,00016438356	$9\frac{1}{2}$	,00026027397

NOTE. *The above Table is thus found.*

As 365 : .03 :: 1 : ,00008219178. *And as* 365 : .035 :: 1 : ,00009586041, &c.

EXAMPLES.

EXAMPLES.

7. What is the interest of £240. for 120 days, at 4 per cent. per annum? *Ans.* $00010958904 \times 240 \times 120 = £3..3..1\frac{1}{2}$.

8. What is the interest of £563. at 6 per cent. per annum, for 126 days? *Ans.* $£11..13.2\frac{1}{2}$.

9. What is the interest of £560. for 60 days, at 5 per cent. per annum? *Ans.* $£4..12..-\frac{1}{2}$.

10. What is the interest of £364..18..- for 154 days, at 5 per cent. per annum? *Ans.* $£7..13..11\frac{1}{4}$.

11. What is the interest of £725..15..- for 74 days, at 4 per cent. per annum? *Ans.* $£5..17..8\frac{1}{2}$.

12. What is the interest of £100. from the 1st of June, 1775, to the 9th of March following, at 5 per cent. per annum? *Ans.* $£3..16..11\frac{3}{4}$.

II. When P, R, T, are given, to find A.

RULE. $prt + p = A$.

EXAMPLES.

13. What will £279..12..- amount to in 7 years, at 4½ per cent. per annum? *Ans.* $£367..13..5. 3,04 \text{ qrs.}$

$$279,6 \times ,045 \times 7 + 279,6 = 367,674.$$

14. What will 320..17..- amount to in 5 years. at 3½ per cent. per annum? *Ans.* $£376..19..11. 2. 8 \text{ qrs.}$

15. What will £679..13..- amount to in 6 years, at 5 per cent. per annum? *Ans.* $£883..10..10. 3,2 \text{ qrs.}$

When there is any odd time given with the whole years, reduce the odd time into days, and work with the decimal parts of a year which are equal to those days.

16. What will £926..12..- amount to in 5 years ½, at 4 per cent. per annum? *Ans.* $£1130..9..- 1,92 \text{ qrs.}$

17. What will £368..16..- amount to in 7 years ¾, at 6½ per cent. per annum? *Ans.* $£554..11..7. 3,68 \text{ qrs.}$

18. What will £273..18..- amount to in 4 years, 175 days, at 3 per cent. per annum?

$$\text{Ans. } £310..14..1. 3,35080064 \text{ qrs.}$$

III. When A, R, T, are given, to find P.

RULE. $\frac{a}{rt + 1} = P$.

EXAMPLES.

19. What principal, being put to interest, will amount to £367..13..5. 3,04 qrs. in 7 years, at $4\frac{1}{2}$ per cent. per annum? *Ans.* $.045 \times 7 + 1 = 1,315$, then $367,674 \div 1,315$

$= £279..12..-$.

20. What principal being put to interest, will amount to £376..19..11. 2,8. in 5 years, at $3\frac{1}{2}$ per cent. per annum?

Ans. £320..17..-.

21. What principal being put to interest, will amount to £883..10..10. 3,2 qrs. in 6 years, at 5 per cent. per annum?

Ans. £679..13..-.

22. What principal, being put to interest, will amount to £1130..9..-. 1,92 qrs. in 5 years $\frac{1}{2}$, at 4 per cent. per annum?

Ans. £926..12..-.

23. What principal will amount to £554..11..7. 3,68 qrs. in 7 years $\frac{3}{4}$, at $6\frac{1}{2}$ per cent. per annum? *Ans.* £368..16..-.

24. What principal will amount to £310..14..1. 3,35080064 qrs. in 4 years, 175 days, at 3 per cent. per annum?

Ans. £273..18..-.

IV. *When A, P, T, are given, to find R.*

a—p
 RULE. $\frac{\text{---}}{\text{pt.}} = R.$

EXAMPLES.

25. At what rate per cent. will £279..12..- amount to £367..13..5. 3,04 qrs. in 7 years?

Ans. $367,674 - 279,6 = 88,074$. $279,6 \times 7 = 1957,2$, then $88,074 \div 1957,2 = .045$ or $4\frac{1}{2}$ per cent.

26. At what rate per cent. will £320..17..- amount to £376..19..11. 2,8 qrs. in 5 years? *Ans.* $3\frac{1}{2}$ per cent.

27. At what rate per cent. will £679..13..- amount to £883..10..10. 3,2 qrs. in 6 years? *Ans.* 5 per cent.

28. At what rate per cent. will £926..12..- amount to £1130..9..-. 1,92 qrs. in 5 years $\frac{1}{2}$? *Ans.* 4 per cent.

29. At what rate per cent. will £368..16..- amount to £554..11..7. 3,68 qrs. in 7 years $\frac{3}{4}$? *Ans.* $6\frac{1}{2}$ per cent.

30. At what rate per cent. will £273..18..- amount to £310..14..1. 3,35080064 qrs. in 4 years, 175 days?

Ans. 3 per cent.

V. *When A, P, R, are given, to find T.*

a—p
 RULE. $\frac{\text{---}}{\text{pr.}} = T.$

EXAMPLES.

EXAMPLES.

31. In what time will £279..12..-. amount to £367..13..-5.
 3,04 qrs. at $4\frac{1}{2}$ per cent. ? *Ans.* 367,674—279,6=88,074.
 $279,6 \times .045 = 12,5820$ then $88,074 \div 12,5820 = 7$ years.
 32. In what time will £320..17..-. amount to £376..19..11.
 2,8 qrs. at $3\frac{1}{2}$ per cent. ? *Ans.* 5 years.
 33. In what time will £679..13..-. amount to £883..10..10.
 3,2 qrs. at 5 per cent. ? *Ans.* 6 years.
 34. In what time will £926..12..-. amount to £1130.9..-.
 1,92 qrs. at $4\frac{1}{2}$ per cent ? *Ans.* 5 years $\frac{1}{2}$.
 35. In what time will £368..16..- amount to £554..11..7.
 3,68 qrs. at $6\frac{1}{2}$ per cent. ? *Ans.* 7 years $\frac{3}{4}$.
 36. In what time will £273..18..- amount to £310..14..1.
 3,35080064 qrs. at 3 per cent ? *Ans.* 4 years, 175 days.

ANNUITIES or PENSIONS, &c. in Arrears.

Annuities or Pensions, &c. are said to be in Arrears, when they are payable or due, either yearly, half-yearly, or quarterly, and are unpaid for any number of payments.

NOTE. U represents the annuity, pension, or yearly rent. T, R, A, as before.

I. U, R, T, are given, to find A.

$$tu - tu$$

$$\text{RULE.} \frac{tu - tu}{2} \times r : + tu = A.$$

2

EXAMPLES.

37. If a salary of £150. be forborne 5 years, at 5 per cent. what would it amount to ? *Ans.* £825.

$$\frac{3000}{2} \times .05 + 5 \times 150 = £825.$$

38. If £250. yearly pension be forborne 7 years, what will it amount to in that time, at 6 per cent. *Ans.* £2065.

39. There is a house let upon a lease for 5 years $\frac{1}{2}$, at £60. per annum, what will be the amount of the whole time, at $4\frac{1}{2}$ per cent ? *Ans.* £363..8..3

40. Suppose an annual pension of £28. remain unpaid for 8 years, what would it amount to at 5 per cent. ?

$$\text{Ans. } £263..4..-$$

Note. *When the annuities, &c. are to be paid half-yearly, or quarterly, then*

For half-yearly payments, take half of the ratio, half of the annuity, &c. and twice the number of years,—and,

For quarterly payments, take a fourth part of the ratio, a fourth part of the annuity, &c. and four times the number of years, and work as before.

E X A M P L E S.

41. If a salary of £150. payable every half-year, remains unpaid for 5 years, what would it amount to in that time, at 5 per cent. ?

Ans. £834..7..6.

42. If a salary of £150. payable every quarter, was left unpaid for 5 years, what would it amount to in that time at 5 per cent. ?

Ans. £839..1..3.

NOTE. *It may be observed, by comparing these last examples, the amount of the half-yearly payments are more advantageous than the yearly, and the quarterly more than the half-yearly.*

II. *When A, R, T, are given, to find U.*

2a

RULE. ————— = U

$ttr - tr + 2t.$

E X A M P L E S.

43. If a salary amounted to £825. in 5 years, at 5 per cent. what was the salary ?

Ans. £150.

$825 \times 2 = 1650.$ $5 \times 5 \times .05 = 5 \times .05 + 5 \times 2 = 11$ then $1650 \div 11 = £150.$

44. If an house is to be let upon a lease for 5 years $\frac{1}{2}$, and the amount for that time be £363..8..3, at $4\frac{1}{2}$ per cent. what is the yearly rent ?

Ans. £60.

45. If a pension amounted to £2065. in 7 years, at 6 per cent, what was the pension ?

Ans. £250.

46. Suppose the amount of a pension be £263..4..—, in 8 years, at 5 per cent. what is the pension ?

Ans. £28.

NOTE. *When the payments are half-yearly, then take 4 a and half of the ratio, and twice the number of years : and if quarterly, then take 8 a, one fourth of the ratio, and four times the number of years, and proceed as before.*

47. If the amount of a salary, payable half-yearly, for 5 years, and at 5 per cent. be £834..7..6. what is the salary ?

Ans. £150.

48. If

48. If the amount of an annuity, payable quarterly, be £839..1..3. for 5 years, at 5 per cent. what is the annuity?

Ans. £150.

III. When U, A, T, are given, to find R.

$$\text{RULE. } \frac{2a - 2ut}{ut - ut.} = R.$$

EXAMPLES.

49. If a salary of £150. per annum amount to £825. in 5 years, what is the rate per cent?

Ans. 5 per cent.

150

$$825 \times 2 - 150 \times 5 \times 2 = 150 \text{ then } \frac{150 \times 5 \times 5 - 150 \times 5}{150} = .05$$

50. If an house be let upon lease for 5 years $\frac{1}{2}$, at £60. per annum, and the amount for that time be £363..8..3. what is the rate per cent.?

Ans. $4\frac{1}{2}$ per cent.

51. If a pension of £250. per annum amounts to £2065. in 7 years, what is the rate per cent.?

Ans. 6 per cent.

52. Suppose the amount of a yearly pension of £28. be £263..4..-. in 8 years, what is the rate per cent.?

Ans. 5 per cent.

NOTE. When the payments are half-yearly, take 4 a—4 ut for a dividend, and work with half the annuity, and double the number of years for a divisor; if quarterly, take 8 a—8 ut, and work with a fourth of the annuity, and four times the number of years.

53. If a salary of £150. per annum, payable half-yearly, amounts to £834..7..6. in 5 years, what is the rate per cent.?

Ans. 5 per cent.

54. If an annuity of £150. per annum, payable quarterly, amounts to £839..1..3. in 5 years, what is the rate per cent.?

Ans. 5 per cent.

IV. When U, A, R, are given, to find T.

$$\text{RULE. First, } \frac{2}{r} - 1 = x : \text{ then } \sqrt{\frac{2a}{ur} + \frac{xx}{4} - \frac{x}{2}} = T.$$

EXAMPLES.

55. In what time will a salary of £150. per annum amount to £825. at 5 per cent.

Ans. 5 years.

56. If

$$\begin{array}{r} 2 \\ \hline .05 \end{array} - 1 = 39 \frac{825 \times 2}{150 \times .05} = 220 \frac{39 \times 39}{4} = 380,25$$

$$\sqrt{220 + 380,25} = 24,5 - \frac{39}{2} = 5 \text{ years.}$$

56. If an house is let upon lease for a certain time for £60. per annum, and the amount be £363..8..3. at $4\frac{1}{2}$ per cent. what time was it let for? *Ans. $5\frac{1}{2}$ years.*

57. If a pension of £250. per annum, being forborne a certain time, amounts to £2065. at 6 per cent. what was the time of forbearance? *Ans. 7 years.*

58. In what time will a yearly pension of £28. amount to £263..4..-. at 5 per cent? *Ans. 8 years.*

Note. If the payments are half-yearly, take half the ratio and half the annuity; if quarterly, one fourth of the ratio, and one fourth of the annuity; and T will be equal to those half-yearly or quarterly payments.

59. If an annuity of £150. per annum, payable half-yearly, amounts to £834..7..6. at 5 per cent. what time was the payment forborne? *Ans. 5 years.*

60. If a yearly pension of £150. payable quarterly, amounts to £839..1..3. at 5 per cent. what was the time of forbearance? *Ans. 5 years.*

Present Worth of ANNUITIES.

Note. P represents the present worth; U, T, R, as before.

I. When U, T, R, are given, to find P.

$$ttr - tr + 2t.$$

RULE. $\frac{ttr - tr + 2t}{2tr + 2} : \times u. = P.$

$$2tr + 2$$

EXAMPLES.

61. What is the present worth of £250. per annum, to continue 5 years, at 5 per cent. *Ans. 660.*

$$\begin{array}{l} 5 \times 5 \times .05 - 5 \times .05 + 5 \times 2 = 11. \quad 5 \times .05 \times 2 + 2 = 2,5 \\ \text{then } 11 \div 2,5 \times 150 = \text{£}660. \end{array}$$

62. What is the yearly rent of a house of £60. to continue $5\frac{1}{2}$ years worth in ready money, at $4\frac{1}{2}$ per cent.?

$$\text{Ans. £}291..6..3.$$

63. What is the present worth of £250. per annum, to continue 7 years, at 6 per cent.?

$$\text{Ans. £}1454..4..6.$$

64. What is a pension of £28. per annum worth in ready money, at 5 per cent. for 8 years? *Ans. £188.*

Note

Note. *The same thing is to be observed as in the first rule of annuities in arrears, concerning half-yearly and quarterly payments.*

65. What is the present worth of £150. payable half-yearly, for 5 years, at 5 per cent. ? *Ans. £667..10..-*

66. What is the present worth of £150. payable quarterly, for 5 years, at 5 per cent. ? *Ans. £671..5..-*

Note. *By comparing the last examples it will be found, that the present worth of half-yearly payments is more advantageous than yearly ; and quarterly than half-yearly.*

II. When P, T, R, are given, to find U.

$$\text{RULE.} \frac{tr+1}{1tr-tr+2t} : \times 2p = U$$

EXAMPLES.

67. If the present worth of a salary be £660. to continue 5 years, at 5 per cent. what was the salary ? *Ans. £150.*

$$5 \times .05 + 1 = 1.25. \quad 5 \times 5 \times .05 - 5 \times .05 + 1 = 11.$$

$$\frac{1.25}{11} \times 660 \times 2 = 150$$

II

68. There is an house let upon lease for $5\frac{1}{2}$ years to come, I desire to know the yearly rent, when the present worth, at $4\frac{1}{2}$ per cent. is £291..6..3. ? *Ans. £60.*

69. What annuity is that which for 7 years continuance, at 6 per cent. produces £1454..4..6. present worth ?

Ans. £250.

70. What annuity is that which for 8 years continuance produces £188. for the present worth, at 5 per cent. ?

Ans. £28.

Note. *When the payments are half-yearly, take half the ratio, twice the number of years, and multiply by 4 p ; and when quarterly take one fourth of the ratio, four times the number of years, and multiply by 8 p.*

71. There is an annuity, payable half-yearly, for 5 years to come, what is the yearly rent, when the present worth, at 5 per cent. is £667..10..- ? *Ans. £150.*

72. There is an annuity, payable quarterly, for 5 years to come, I desire to know the yearly income, when the present worth, at 5 per cent. is £671..5..- ? *Ans. £150.*

III. When U, P, T, are given, to find R.

$$\text{RULE.} \frac{ut-p \times 2}{2pt+ut-utt} = R.$$

EXAMPLES.

E X A M P L E S.

73. At what rate per cent. will an annuity of £150. per annum, to continue 5 years, produce the present worth of £660. ? *Ans. 5 per cent.*

$$150 \times 5 - 660 \times 2 = 180.2 \times 660 \times 5 + 150 \times 5 - 150 \times 5 \times 5 \\ = 3600 \text{ then } 180 \div 3600 = .05 = 5 \text{ per cent.}$$

74. If a yearly rent of £60. per annum, to continue 5½ years produce £291..6..3. for the present worth, what is the rate per cent. ? *Ans. 4½ per cent.*

75. If an annuity of £250. per annum, to continue 7 years, produce £1454..4..6. for the present worth, what is the rate per cent. ? *Ans. 6 per cent.*

76. If a pension of £28. per annum, to continue 8 years, produces £188. for the present worth, what is the rate per cent. ? *Ans. 5 per cent.*

Note. When the annuities, or rents, &c. are to be paid half-yearly, or quarterly, then

For half-yearly payments take half of the annuity, &c. and twice the number of years, the quotient will be the ratio of half the rate per cent.—and,

For quarterly payments, take a fourth part of the annuity, &c. and four times the number of years, the quotient will be the ratio of a fourth part of the rate per cent.

77. If an annuity of £150. per annum, payable half-yearly, having 5 years to come, is sold for £667..10..-. what is the rate per cent. ? *Ans. 5 per cent.*

78. If an annuity of £150. per annum, payable quarterly, having 5 years to come, is sold for £671..5..-. what is the rate per cent. ? *Ans. 5 per cent.*

IV. When U, P, R, are given, to find T.

$$\text{RULE. } \frac{z}{r} - \frac{2p}{u} - 1 = x \text{ then } \sqrt{\frac{2p}{ur} + \frac{xx}{4} - \frac{x}{2}} = T.$$

E X A M P L E S.

79. If an annuity of £150. per annum produce £660. for the present worth, at 5 per cent. what is the time of its continuance ? *Ans. 5 years.*

$$\begin{array}{r}
 \frac{2}{105} \quad \frac{660 \times 2}{150} \quad \frac{660 \times 2}{150 \times 105} \\
 \frac{30,2 \times 30,2}{4} - 1 = 30,2 \quad \frac{660 \times 2}{150 \times 105} = 176 \\
 \frac{30,2}{2} = 228,01 \text{ then } \sqrt{228,01 + 176} = 20,1 \\
 \frac{20,1}{2} = 5 \text{ years.}
 \end{array}$$

80. For what time may a salary of £60. be purchased for £291..6.. 3. at $4\frac{1}{2}$ per cent? *Ans.* $5\frac{1}{2}$ years.

81. For how long time may £250. per annum be purchased for £1454..4..6. at 6 per cent? *Ans.* 7 years.

82. What time may a pension of £28. per annum be bought for £188. at 5 per cent.? *Ans.* 8 years.

NOTE. When the payments are half-yearly, then U will be equal to the half annuity, &c. R, half the ratio, and T the number of payments; and

When the payments are quarterly, U will be equal to a fourth part of the annuity, &c. R, the fourth of the ratio, and T the number of payments.

83. If an annuity of £150. per annum, payable half-yearly, is sold for £667..10..-. at 5 per cent. I desire to know the number of payments, and the time to come?

Ans. 10 payments, 5 years.

84. An annuity of £150. per annum, payable quarterly is sold for £671..5..-. at 5 per cent. what is the number of payments and time to come? *Ans.* 20 payments 5 years.

ANNUITIES, &c. taken in REVERSION.

1. To find the present worth of an annuity, &c. taken in reversion.

RULE. Find the present worth of the yearly sum at the given rate, and for the time of its continuance, $\frac{tr - tr + 2t}{2tr + 2} \times u = P$.

2. Change P. into A. and find what principal being put to interest will amount to A. at the same rate, and for the time to come before the annuity, &c. commences, thus,

$$\frac{a}{tr + 1} = P.$$

EXAMPLES

EXAMPLES.

85. What is the present worth of an annuity of £150. per annum, to continue 5 years, but not to commence till the end of 4 years, allowing 5 per cent. to the purchaser?

Ans. £550.

$$\begin{array}{r} \underline{\underline{5 \times 5 \times .05 - 5 \times .05 \times 2 \times 5 = 4,4 \times 150 = 660}} \\ \underline{\hspace{10em} = 550} \\ \hspace{10em} 5 \times .05 \times 2 + 2 \hspace{10em} 4 \times .05 + 1 \end{array}$$

86. What is the present worth of a lease of £50. per annum, to continue 4 years, but is not to commence till the end of 5 years, allowing 4 per cent. to the purchaser?

Ans. 152..5..11. 3 qrs.

87. A person having the promise of a pension of £20. per annum, for 8 years, but not to commence till the end of 4 years, is willing to dispose of the same, at 5 per cent. what will be the present worth?

Ans. £111..18..1.14+.

88. A legacy of £40. being left for 6 years to a person of 15 years of age, but is not to commence till he is 21; he wanting money, is desirous of selling the same at 4 per cent. what is the present worth?

Ans. £171..14..-.

2. To find the yearly income of an annuity, &c. in reversion.

RULE. 1. Find the amount of the present worth at the given $ptr + p = A$.
rate, and for the time before the reversion, *thus,*

2. Change A. into P. and find what annuity being sold will produce P. at the same rate, and for the time of its continuance, *thus,*

$$\frac{tr + 1}{ttr - tr + 2t} : \times 2p = U$$

EXAMPLES.

89. A person having an annuity left him for 5 years, which does not commence till the end of 4 years, disposed of it for £550. allowing 5 per cent. to the purchaser, what was the yearly income?

Ans. £150.

$$\begin{array}{r} \underline{\underline{550 \times 4 \times .05 + 550 = 660}} \\ \underline{\hspace{10em} 5 \times .05 + 1,} \\ 5 \times 5 \times .05 - 5 \times .05 + 5 \times 2 \\ =,113636 \times 660 \times 2 = £150. \hspace{10em} 90. There \end{array}$$

90. There is a lease of an house taken for 4 years, but not to commence till the end of 5 years, the lessee would sell the same for £152..6..-. present payment, allowing 4 per cent. to the purchaser, what is the yearly rent? *Ans.* £50.

91. A person having the promise of a pension for 8 years, which does not commence till the end of 4 years, has disposed of the same for £111..18..1,14 present money, allowing 5 per cent. to the purchaser, what was the pension?

Ans. £20.

92. There is a certain legacy left to a person of 15 years of age, which is to be continued for 6 years, but not to commence till he arrives to the age of 21; he wanting a sum of money, sells it for £171..14..-. allowing 4 per cent. to the buyer, what was the annuity left him? *Ans.* £40.

REBATE or DISCOUNT.

NOTE. S represents the Sum to be discounted.

P the Present Worth.

T the Time.

R the Ratio.

I. When S, T, R, are given, to find

RULE. $\frac{S}{1+R \times T} = P$.

EXAMPLES.

1. What is the present worth of £357..10..-. to be paid 9 months hence, at 5 per cent.? *Ans.* £344..11..6. 3,168 qrs.

$$\frac{357,5}{1,05 \times .75 + 1} = 344,5783$$

2. What is the present worth of £275..10..-. due 7 months hence, at 5 per cent.? *Ans.* £267..13..10. 1,64d.

3. What is the present worth of £875..5..6. due 5 months hence, at $4\frac{1}{2}$ per cent.? *Ans.* £859.3.3.3,2544 qrs. +.

4. How much ready money can I receive for a note of £75. due 15 months hence, at 5 per cent.

Ans. £70..11..9. 1,764d.

II. *When P, T, R, are given, to find S.*RULE. $ptr + p = S$.

EXAMPLES.

5. If the present worth of a sum of money due 9 months hence, allowing 5 per cent. be £344..11..6. 3,168 *qrs.* what was the sum first due?

Ans. £357..10..-.

$$344,5783 \times ,75 \times 05 \times 344,5783 = £357..10..-.$$

6. A person owing a certain sum, payable 7 months hence, agrees with the creditor to pay him down £267..13..10, 164*d.* allowing 5 per cent. for present payment, what is the debt?

Ans. £275..10..-.

7. A person receives £859..3..3, 254 *qrs.* for a sum of money due 5 months hence, allowing the debtor $4\frac{1}{2}$ per cent. for present payment, what was the sum due?

Ans. £875..5..6.

8. A person paid £70..11..9. ,1764 for a debt due 15 months hence, he being allowed 5 per cent. for the discount, how much was the debt?

Ans. £75.

III. *S, P, T, are given, to find R.*

RULE. $\frac{s-p}{tp} = R$.

EXAMPLES.

9. At what rate per cent. will £357..10..- payable 9 months hence, produce £344..11..6. 3,168 *qrs.* for present payment?

Ans. 5 per cent.

$$\frac{357,5 - 344,5783}{344,5783 \times ,75} = ,05 = 5 \text{ per cent.}$$

10. At what rate per cent. will £275..10..- payable 7 months hence, produce £267..13..10. ,164*d.* for present payment?

Ans. 5 per cent.

11. At what rate per cent. will £875..5..6. payable 5 months hence, produce the present payment of £859..3..3. 3,2544 *qrs.*?

Ans. $4\frac{1}{2}$ per cent.

12. At what rate per cent. will £75 payable 15 months hence, produce the present payment of £70..11..9. ,1764?

Ans. 5 per cent.

IV. *When*

IV. When S, P, R, are given, to find T.

RULE. $\frac{s-p}{rp} = T$.

EXAMPLES.

13. The present worth of £357..10..-. due for a certain time to come, is £344..11..6. 3,168 *grs.* at 5 per cent. in what time should the sum have been paid without any rebate?

Ans. 9 months.

$$\frac{357,5 - 344,5783}{344,5783 \times ,05} = ,75 = 9 \text{ months.}$$

14 The present worth of £275..10..-. due for a certain time to come, is £267..13..10. ,164*d.* at 5 per cent. in what time should the sum have been paid without any rebate?

Ans. 7 months.

15. A person receives £859..3..3,2544 *grs.* for £875..5..6. due at a certain time to come, allowing 4½ per cent. discount; I desire to know in what time the debt should have been discharged without any rebate?

Ans. 5 months.

16. I have received £70..11..9.,1752*d.* for a debt of £75. allowing the person 5 per cent. for prompt payment, I desire to know when the debt would have been payable without the rebate.

Ans. 15 months.

EQUATION OF PAYMENTS.

To find the equated time for the payment of a sum of money due at several times.

RULE. Find the present worth of each s payment for its respective time, thus, $\frac{s}{tr+1} = P$.

Add all the present worths together, then $s - \frac{P}{d} = D$.

and $\frac{D}{pr} = E$.

EXAMPLES.

1. D owes E £200. whereof £40. is to be paid at 3 months, £60. at 6 months, and £100. at 9 months; at what time may the whole debt be paid together, rebate being made at 5 per cent. ?

Ans. 6 months 26 days.

$$\begin{array}{r} 40 \qquad \qquad \qquad 60 \qquad \qquad \qquad 100 \\ \hline \text{---} = 39,5061 \text{---} = 58,5365 \text{---} = 96,3855 \\ 1,0125 \qquad \qquad 1,025 \qquad \qquad 1,0375 \end{array}$$

$$\text{then } 200 - 39,5061 + 58,5365 + 96,3855 = 5,5719$$

$$5,5719$$

$$\text{---} = 5,7315 = 6 \text{ months, } 26 \text{ days.}$$

$$194,4281 \times .05$$

2. D owes F £800. whereof £300. is to be paid in 3 months, £200. at 4 months, and £400. at 6 months; but they agreeing to make but one payment of the whole, at the rate of 5 per cent rebate, the true equated time is demanded?

Ans. 4 months, 22 days.

3. E owes F £1200. which is to be paid as follows: £200. down, £500. at the end of 10 months, and the rest at the end of 20 months; but they agreeing to have one payment of the whole, rebate at 3 per cent. the true equated time is demanded.

Ans. 1 year, 11 days.

COMPOUND INTEREST.

THE letters made use of in Compound Interest are,

A the Amount.

P the Principal.

T the Time.

R the Amount of £1. for 1 year, at any given rate; which is thus found:

$$\text{As } 100 : 105 :: 1 : 1,05. \qquad \text{As } 100 : 105,5 :: 1 : 1,055.$$

A TABLE of the amount of £1. for One Year.

Rates per cent.	Amts. of £1.	Rates per cent.	Amts. of £1.	Rates per cent.	Amts. of £1.
3	1,03	5½	1,055	8	1,08
3½	1,035	6	1,06	8½	1,085
4	1,04	6½	1,065	9	1,09
4½	1,045	7	1,07	9½	1,095
5	1,05	7½	1,075	10	1,1

A TABLE,

A^c TABLE, shewing the amount of £1. for any number of years under 31, at 5 and 6 per cent. per annum.

Years.	5	Rates	6	Yrs.	5	Rates	6
1	1,05000		1,06000	16	2,18287		2,54035
2	1,10250		1,12360	17	2,29201		2,69277
3	1,15762		1,19101	18	2,40662		2,85434
4	1,21550		1,26247	19	2,52695		3,02559
5	1,27628		1,33822	20	2,65329		3,20713
6	1,34009		1,41852	21	2,78596		3,39956
7	1,40710		1,50363	22	2,92526		3,60353
8	1,47745		1,59384	23	3,07152		3,81975
9	1,55132		1,68948	24	3,22510		4,04893
10	1,62889		1,79084	25	3,38635		4,29187
11	1,71034		1,89829	26	3,55567		4,54938
12	1,79585		2,01219	27	3,73345		4,82234
13	1,88565		2,13292	28	3,92013		5,11168
14	1,97993		2,26090	29	4,11613		5,41838
15	2,07892		2,39655	30	4,32194		5,74349

NOTE. The above table is thus made: As 100 : 105 :: 1 : 1,05 for the first year; then, As 100 : 1,05 :: 105 : 1,025, second year, &c.

I. When P, T, R, are given, to find A.

RULE. $P \times R^T = A$.

EXAMPLES.

1. What will £225. amount to in 3 years time, at 5 per cent. per annum? *Ans.* $1,05 \times 1,05 \times 1,05 = 1,157625$ then $1,157625 \times 225 = £260. 9..3. 3$ qrs.

2. What will £200. amount to in 4 years, at 5 per cent. per annum? *Ans.* £243. 2,025s.

3. What will £450. amount to in 5 years, at 4 per cent. per annum? *Ans.* £547..9..10. 2,0538368 qrs.

4. What will £500. amount to in 4 years, at $5\frac{1}{2}$ per cent. per annum? *Ans.* £619..8..2. 3,8323 qrs.

II. When A, R, T, are given, to find P.

RULE. $\frac{A}{R^T} = P$.

E X A M P L E S.

5. What principal being put to interest will amount to £260..9..3. 3 qrs. in 3 years, at 5 per cent. per annum?

$$260,465625 \\ 1,05 \times 1,05 \times 1,05 = 1,157625. \frac{260,465625}{1,157625} = £225.$$

6. What principal being put to interest will amount to £243. 2,025s. in 4 years, at 5 per cent. per annum?

Ans. £200.

7. What principal will amount to £547..9..10. 2,0538368 qrs. in 5 years, at 4 per cent. per annum?

Ans. £450.

8. What principal will amount to £619..8..2. 3,8323 qrs. in 4 years, at $5\frac{1}{2}$ per cent?

Ans. £500.

III. When P, A, T, are given, to find R.

a which being extracted by the rule of ex-
 RULE.—= $\frac{a}{p}$ traction, (the time given to the question
p shewing the power) will give R.

E X A M P L E S.

9. At what rate per cent. will £225. amount to £260..9..3. 3 qrs. in 3 years? *Ans.* 5 per cent.

$$260,465625 \\ \frac{260,465625}{225} = 1,157625 \text{ the cube root of which}$$

(it being the 3d power) = 1,05 = 5 per cent.

10. At what rate per cent. will £200. amount to £243. 2,025s. in 4 years? *Ans.* 5 per cent.

11. At what rate per cent. will £450. amount to £547..9..10. 2,0538368 qrs. in 5 years? *Ans.* 4 per cent.

12. At what rate per cent. will £500 amount to £619..8..2. 3,8323 qrs. in 4 years? *Ans.* $5\frac{1}{2}$ per cent.

IV. When P, A, R, are given, to find T.

a which being continually divided by R, till
 RULE.—= $\frac{a}{p}$ nothing remains, the number of those divi-
p sions will be equal to T.

E X A M P L E S.

EXAMPLES.

13. In what time will £225. amount to £260..9..3. 3 qrs. at 5 per cent.?

$$\begin{array}{r} 260,465625 \\ \hline 225 \end{array} = 1,157625 \quad \begin{array}{r} 1,157625 \\ \hline 1,05 \end{array} = 1,1025 \quad \begin{array}{r} 1,1025 \\ \hline 1,05 \end{array} = 1,05 \quad \begin{array}{r} 1,05 \\ \hline 1,05 \end{array}$$

= 1. The number of divisions being 3 = time sought.

14. In what time will £200. amount to £243. 2,025s. at 5 per cent.?

Ans. 4 years.

15. In what time will £450. amount to £547..9..10. 2,0538368 qrs. at 4 per cent.?

Ans. 5 years.

16. In what time will £500. amount to £619..8..2,38323 qrs. at $5\frac{1}{2}$ per cent.?

Ans. 4 years.

ANNUITIES, or PENSIONS, in ARRERRS.

NOTE. U represents the annuity, pension, or yearly rent; A, R, T, as before.

A TABLE, shewing the amount of £1. annuity for any number of years under 31, at 5 and 6 per cent. per annum.

Yrs.	5 Rates	6	Yrs.	5 Rates	6
1	1,00000	1,00000	16	23,65749	25,67252
2	2,05000	2,06000	17	25,84036	28,21288
3	3,15250	3,18360	18	28,13238	30,90565
4	4,31012	4,37461	19	30,53900	33,75990
5	5,52563	5,63709	20	33,06595	36,78550
6	6,80191	6,97532	21	35,71925	39,99270
7	8,14200	8,39383	22	38,50521	43,39220
8	9,54910	9,89746	23	41,43047	46,99580
9	11,02656	11,49131	24	44,50199	50,81550
10	12,57789	13,18079	25	47,72709	54,86450
11	14,20678	14,97164	26	51,11345	59,15630
12	15,91712	16,86994	27	54,66912	63,70570
13	17,71298	18,88243	28	58,40258	68,52810
14	19,59863	21,01506	29	62,32271	73,63970
15	21,57856	23,27597	30	66,43884	79,05810

Note. The above table is made thus: take the first year's amount, which is £1. multiply it by $1,05 + 1 = 2,05$ = second year's amount, which also multiply by $1,05 + 1 = 3,1525$ = third year's amount.

I. When

I. When U, T, R, are given, to find A.

$$\text{RULE. } \frac{ur^t - u}{r - 1} = A, \text{ or by the table thus,}$$

Multiply the amount of £1. for the number of years, and at the rate per cent. given in the question, by the annuity, pension, &c. and it will give the answer.

EXAMPLES.

17. What will an annuity of £50. per annum, payable yearly, amount to in 4 years, at 5 per cent?

$$\text{Ans. } 1,05 \times 1,05 \times 1,05 \times 1,05 \times 50 = 60,77531250$$

$$\text{then, } \frac{60,7753125 - 50}{1,05 - 1} = £215..10..1. 2 \text{ qrs. or,}$$

by the table thus, $4,31012 \times 50 = £215..10..1. 1,76 \text{ qrs.}$

18. What will a pension of £45. per annum, payable yearly, amount to in 5 years, at 5 per cent?

$$\text{Ans. } £248..13..-. 3,27 \text{ qrs.}$$

19. If a salary of £40. per annum, to be paid yearly, be forborne 6 years, at 6 per cent. what is the amount?

$$\text{Ans. } £279..-. 3,072d.$$

20. If an annuity of £75. per annum, payable yearly, be omitted to be paid for 10 years, at 6 per cent. what is the amount?

$$\text{Ans. } £988..11.. 2,22d.$$

II. When A, R, T, are given, to find U.

$$\text{RULE. } \frac{ar - a}{r - 1} = U.$$

EXAMPLES.

21. What annuity, being forborne 4 years, will amount to £215..10..1. 2 qrs. at 5 per cent.?

$$\text{Ans. } \frac{215,50625 \times 1,05 - 215,50625}{1,05 \times 1,05 \times 1,05 \times 1,05 - 1} = £50.$$

22. What

22. What pension being forborne 5 years will amount to £248..13..-. 3,27 qrs. at 5 per cent. ? *Ans. £45.*

23. What salary being omitted to be paid 6 years will amount to £279..-. 3,072d. at 6 per cent. ? *Ans. £40.*

24. If the payment of an annuity be forborne 10 years amount to £988..11.. 2,22d. at 6 per cent. what is the annuity ? *Ans. £75.*

III. When U, A, R, are given, to find T.

ar + u - a which being continually divided by R,
 RULE. $\frac{\text{---}}{u} = rt$ till nothing remains, the number of those
 divisions will be equal to T.

EXAMPLES.

25. In what time will £50. per annum amount to £415..10..1. 2 qrs. at 5 per cent. for non-payment ?

$$\text{Ans. } 215,50625 \times 1,05 + 50 = 215,50625$$

$\frac{50}{\text{---}}$
 which being continually divided by R, the number of those divisions will be = 4 years.

26. In what time will £45. per annum amount to £248..13..-. 3,27 qrs. allowing 5 per cent. forbearance of payment ? *Ans. 5 years.*

27. In what time will £40. per annum amount to £279..-. 3,072, at 6 per cent. ? *Ans. 6 years.*

28. In what time will £75. per annum amount to £988..11.. 2,22d. allowing 6 per cent. for forbearance of payment ? *Ans. 10 years.*

PRESENT WORTH OF ANNUITIES, PENSIONS, &c.

A TABLE shewing the present worth of £1. annuity for any number of years under 31, rebate at 5 and 6 per cent.

<i>Yrs.</i>	5	Rates	6	<i>Yrs.</i>	5	Rates	6
1	0,95238		0,94339	16	10,83777		10,10589
2	1,85941		1,83339	17	11,27406		10,47726
3	2,72324		2,67301	18	11,68958		10,82760
4	3,54595		3,46510	19	12,08532		11,15811
5	4,32947		4,21236	20	12,46221		11,46992
6	5,07569		4,91732	21	12,82115		11,76407
7	5,78637		5,58238	22	13,16300		12,04158
8	6,46321		6,20979	23	13,48857		12,30338
9	7,10782		6,80169	24	13,79864		12,55035
10	7,72173		7,36008	25	14,09394		12,78335
11	8,30641		7,88687	26	14,37518		13,00316
12	8,86325		8,38384	27	14,64303		13,21053
13	9,39357		8,85268	28	14,89812		13,40616
14	9,89864		9,29498	29	15,14107		13,59072
15	10,37965		9,71225	30	15,37245		13,76483

Note. The above table is thus made: divide £1. by 1,05 =,95238, the present worth of the first year, which $\div 1,05$ =,90703, added to the first year's present worth = 1,85941, the second year's present worth; then, $90703 \div 1,05$ and the quotient added to 1,85941 = 2,72324, third year's present worth, &c.

I. When U, T, R, are given, to find P.

$$\text{RULE. } \frac{u - \frac{u}{r^t}}{r - 1} = P.$$

or, by the table, thus,

Multiply the present worth of £1. annuity for the time and rate per cent. given, by the annuity, pension, &c. it will give the answer.

EXAMPLES.

EXAMPLES.

29. What is the present worth of an annuity of £30. per annum, to continue 7 years, at 6 per cent.?

Ans. £167..9..5. ,184*d.*

$$\begin{array}{r} 30 \\ \hline 1,50363 \\ \hline \end{array} = 19,9517. \quad \begin{array}{r} 30 - 19,9517 = 10,0483 \\ \hline 1,06 - 1 \\ \hline \end{array} = 167,4716. \quad \text{By the table } 5,58238 \times 30 = 167,4716.$$

30. What is the present worth of a pension of £40. per annum, to continue 8 years at 5 per cent.?

Ans. £258..10..6. 3,264 *qrs.*

31. What is the present worth of a salary of £35. to continue 7 years, at 6 per cent.?

Ans. £195..7..7. 3,968 *qrs.*

32. What is the yearly rent of £50. to continue 5 years, worth in ready money, at 5 per cent.?

Ans. £216..9..5. 2,56 *qrs.*

II. When P, T, R, are given, to find U.

$$\begin{array}{c} \text{pr} \times r - \text{pr} \\ \text{RULE.} \frac{\quad}{r - 1} = U. \end{array}$$

EXAMPLES.

33. If an annuity be purchased for £167..9..5. ,184*d.* to be continued 7 years, at 6 per cent. what is the annuity?

$$\begin{array}{r} \text{Ans. } 167,4716 \times 1,50363 \times 1,06 - 167,4716 \times 1,50363 \\ \hline 1,50363 - 1 \quad \quad \quad = £30. \end{array}$$

34. If the present payment of £258..10..6. 3,264 *qrs.* be made for a salary 8 years to come, at 5 per cent. what is the salary?

Ans. £40.

35. If the present payment of £195..7..7. 3,968 *qrs.* were required for a pension for 7 years to come, at 6 per cent. what is the pension?

Ans. £35.

36. If the present worth of an annuity, 5 years to come, be £216..9..5. 2,56 *qrs.* at 5 per cent. what is that annuity?

Ans. £50.

III. When

III. When U, P, R, are given, to find T.

RULE. ————— $\frac{u}{p+u-pr}$ = $\frac{u}{r}$ *which being continually divided by R. till nothing remains, the number of those divisions will be equal to T.*

E X A M P L E S.

37. How long may a lease of £30. yearly rent be had for £167..9..5. 184*d.* allowing 6 per cent. to the purchaser?

Ans. ————— $\frac{30}{167,4716 + 30 - 177,5198}$ = 1,50363 *which being continually divided, the number of those divisions will be = to T. = 7 years.*

38. If £258..10..6. 3,264 *qrs.* is paid down for a lease of £40. per annum, at 5 per cent. how long is the lease purchased for?

Ans. 8 years.

39. If a house is let upon lease for £35. per annum, and the lessee makes present payment of £195..7..8. he being allowed 6 per cent. I demand how long the lease is purchased for?

Ans. 7 years.

40. For what time may a lease of £50. per annum be purchased, when present payment is made of £216..9..5. 2,56 *qrs.* at 5 per cent?

Ans. 5 years.

ANNUITIES, LEASES, &c. taken in REVERSION.

To find the present worth of annuities, leases, &c. taken in reversion.

RULE I. Find the present worth of the annuity, &c. at the given rate, and for the time of its continuance; thus,

$$u - \frac{u}{r^t} = P$$

$$\frac{r-1}{r^t}$$

2. Change P into A, and find what principal being put to interest will amount to P at the same rate, and for the time to come, before the annuity commences, which will be the present worth of the annuity, &c. thus,

$$\frac{a}{r^t} = R.$$

E X A M P L E S.

EXAMPLES.

41. What is the present worth of a reversion of a lease of £40. per annum, to continue for six years, but not to commence till the end of 2 years, allowing 6 per cent. to the purchaser?

Ans. £175..1..1. 2048 qrs.

$$\begin{array}{r} 40 \\ \hline 1,41852 \end{array} = 28,1984. \quad \begin{array}{r} 40 - 28,1984 \\ \hline 1,06 - 1 \end{array} = 196,6933. \quad \begin{array}{r} 196,6933 \\ \hline 1,1236 \end{array}$$

$$= 175,0563$$

42. What is the present worth of a reversion of a lease of £60. per annum, to continue 7 years, but not to commence till the end of 3 years, allowing 5 per cent. to the purchaser?

Ans. £299..18. 2,4d.

43. There is a lease of a house at £30. per annum, which is yet in being for 4 years, and the lessee is desirous to take a lease in reversion for 7 years, to begin when the old lease shall be expired, what will be the present worth of the said lease in reversion, allowing 5 per cent. to the purchaser?

Ans. £142..16..3. 2,688 qrs.

To find the early income of an annuity, &c. taken in reversion.

Rule. Find the amount of the present worth, at the given rate, and for the time before the annuity commences; thus, $prt = A$.

Change A into P, and find what yearly rent being sold will produce P, at the same rate, and for the time of its continuance, which will be the yearly sum $prt \times r - prt$ required. thus, $\frac{prt \times r - prt}{r - 1} = U$.

EXAMPLES.

44. What annuity to be entered upon 2 years hence, and then to continue 6 years, may be purchased for £175..1..1. 2,048 qrs. at 6 per cent.?

$$\begin{array}{l} \text{Ans. } 175,0563 \times 1,1236 = 196,6933 \\ \text{then } 196,6933 \times 1,41852 \times 1,06 - 279,01337 \\ \hline 1,41852 - 1 \\ \text{P} \end{array} = £40.$$

45. The

45. The present worth of a lease of an house is £299..18. 2,4d. taken in reversion for 7 years, but not to commence till the end of 3 years, allowing 5 per cent. to the purchaser, what is the yearly rent? *Ans.* £60.

46. There is a lease of a house in being for 4 years, and the lessee being minded to take a lease in reversion for 7 years, to begin when the old lease shall be expired, paid down £142..16..3. 2,688 *qrs.* what was the yearly rent of the house, when the lessee was allowed 5 per cent. for present payment? *Ans.* £30.

*Purchasing FREEHOLD or REAL ESTATES,
is such as is bought to continue for ever.*

I. When U, R, are given, to find W.

$$\text{RULE. } \frac{u}{r-1} = W.$$

EXAMPLES.

47. What is the worth of a freehold estate of £50. per annum, allowing 5 per cent. to the buyer?

$$\text{Ans. } \frac{50}{1,05-1} = £1000.$$

48. What is an estate of £140. per annum, to continue for ever, worth in present money, allowing 4 per cent. to the buyer? *Ans.* £3500.

49. If a freehold estate of £75. yearly rent was to be sold, what is it worth, allowing the buyer 6 per cent? *Ans.* £1250.

II. When W, R, are given, to find U.

$$\text{RULE. } w \times r - 1 = U.$$

EXAMPLES.

50. If a freehold estate is bought for £1000. and the allowance of 5 per cent. is made to the buyer, what is the yearly rent? *Ans.* $1,05-1=,05$. then $1000 \times ,05 = £50$.

51. If an estate be sold for £3500. and 4 per cent. allowed to the buyer, what is the yearly rent? *Ans.* £140.

52. If a freehold estate is bought for £1250. present money, and an allowance of 6 per cent. made to the buyer for the same, what is the yearly rent? *Ans.* £75.

III. When W, U, are given, to find R.

$$\text{RULE. } \frac{w+u}{w} = R.$$

EXAMPLES.

53. If an estate of £50. per annum is bought for £1000. what is the rate per cent?

$$\text{Ans. } \frac{1000 + 50}{1000} = 1.05 = 5 \text{ per cent.}$$

54. If a freehold estate of £140. per annum be bought for £3500. what was the rate per cent. allowed? *Ans. 4 per cent.*

55. If an estate of £75. per annum is sold for £1250. what is the rate per cent. allowed? *Ans. 6 per cent.*

Purchasing FREEHOLD ESTATES in REVERSION.

To find the worth of a freehold estate in reversion.

RULE. Find the worth of the yearly rent, thus, $\frac{u}{r} = W$.
Change W into A, and find what principal being put to interest, will amount to A at the same rate, and for the time to come, before the estate commences, and that will be the worth of the estate in reversion; thus, $\frac{a}{r} = P$.

EXAMPLES.

56. If a freehold estate of £50. per annum, to commence 4 years hence, is to be sold, what is it worth, allowing the purchaser 5 per cent. for present payment?

$$\text{Ans. } \frac{50}{1.05 - 1} = 1000. \text{ then } \frac{1000}{1.2155} = £822..14..1. 2 \text{ qrs.} +$$

57. What is an estate of £200. to continue for ever, but not to commence till the end of 2 years, worth in ready money, allowing the purchaser 4 per cent.?

$$\text{Ans. } £4622..15..7. 44 \text{ qrs.}$$

58. What is an estate of £240. per annum worth in ready money, to continue for ever, but not to commence till the end of 3 years, allowance being made at 6 per cent.?

$$\text{Ans. } £3358..9..6. 2, 24 \text{ qrs.}$$

To find the yearly rent of an estate taken in reversion.

RULE. Find the amount of the worth of the estate, at the given rate and time before it commences; thus, $wrt = A$.

Change A into W, and find what yearly rent being sold will produce U, at the same rate; thus $\frac{wr \times r - wr}{r} = U$.
which will be the yearly rent required.

EXAMPLES.

59. If a freehold estate, to commence 4 years hence, is sold for £822..14..1. ,2 *grs.* allowing the purchaser 5 per cent. what is the yearly income?

$$\text{Ans. } 822,70625 \times 1,2155 = 1000.$$

$$\text{then } 1000 \times 1,05 \times 1,05 = 1050.$$

$$= £50.$$

1,05

60. A freehold estate is bought for £4622..15..7. ,44*d.* which does not commence till the end of 2 years, the buyer being allowed 4 per cent. for his money; I desire to know the yearly income?

$$\text{Ans. } £200.$$

61. There is a freehold estate sold for £3358..9..6 2,24 *grs.* but not to commence till the expiration of 3 years, allowing 6 per cent. for present payment; what is the yearly income?

$$\text{Ans. } 240.$$

REBATE or DISCOUNT.

A TABLE shewing the present worth of £1. due any number of years, to commence under 31, rebate at 5 and 6 per cent.

<i>Years.</i>	5	Rates	6	<i>Years.</i>	5	Rates	6
1	,952381		,943396	16	,458111		,393647
2	,907030		,889996	17	,436296		,371364
3	,863838		,839619	18	,415520		,350343
4	,822702		,792093	19	,395734		,330513
5	,783526		,747258	20	,376889		,311804
6	,746215		,704960	21	,358942		,294155
7	,710682		,665057	22	,341849		,277505
8	,676839		,627412	23	,325571		,261797
9	,644609		,591898	24	,310067		,246978
10	,613913		,558394	25	,295302		,232998
11	,584679		,526787	26	,281240		,219810
12	,556837		,496969	27	,267848		,207368
13	,530321		,468839	28	,255093		,195630
14	,505068		,442301	29	,242946		,184556
15	,481017		,417265	30	,231377		,174110

Note. The above table is thus made: $1 \div 1,05 = ,952381$ first year's present worth; and $,952381 \div 1,05 = ,90703$ second year; and $,90703 \div 1,05 = ,863838$ third year, &c.

I. When

I. When S, T, R, are given, to find P.

$$\text{RULE. } \frac{s}{rt} = P.$$

EXAMPLES.

1. What is the present worth of £315..12..4. 2d. payable 4 years hence, at 6 per cent.?

Ans. $1,06 \times 1,06 \times 1,06 \times 1,06 = 1,26247$. then
by the table.

$$\frac{315,6175}{1,26247} = £250$$

$$\begin{array}{r} 315,6175 \\ ,792093 \\ \hline 249,9984124275 \end{array}$$

2. If £344..14..9. 1,92 qrs. be payable in 7 year's time, what is the present worth, rebate being made at 5 per cent.?

Ans. £ 245.

3. There is a debt of £441..17..3. 1,92 qrs. which is payable 4 years hence, but it is agreed to be paid in present money; what sum must the creditor receive, rebate being made at 6 per cent.?

Ans. £350.

II. When P, T, R, are given, to find S.

$$\text{RULE. } p \times rt = S.$$

EXAMPLES.

4. If a sum of money due 4 years hence produce £250. for the present payment, rebate being made at 6 per cent. what was the sum first due?

Ans. $250 \times 1,26247 = £315..12..4. ,2d.$

5. If £245. be received for a debt payable 7 years hence, and an allowance of 5 per cent. to the debtor for present payment, what was the debt?

Ans. £344..14..9. 1,92 qrs.

6. There is a sum of money due at the expiration of 4 years, but the creditor agrees to take £350. for present payment, allowing 6 per cent. what was the debt?

Ans. £441..17..3. 1,92 qrs.

III. When S, P, R, are given, to find T.

$$\text{RULE. } \frac{s}{p} = rt \quad \text{which being continually divided by R, till nothing remains, the number of those divisions will be equal to T.}$$

EXAMPLES.

7. The present payment of £250. is made for a debt of £315..12..4. ,2d. rebate at 6 per cent. in what time was the debt payable?

$$\text{Ans. } \frac{315,6175}{250} = 1,26247 \quad \begin{array}{l} \text{which being continually divided,} \\ \text{those divisions will be equal to 4} \\ \text{= the number of years.} \end{array}$$

8. A person receives £245. now for a debt of £344..14..9. 1,92 qrs. rebate being made at 5 per cent. I demand in what time the debt was payable? *Ans. 7 years.*

9. There is a debt of £441..17..3. 1,92 qrs. due at a certain time to come, but 6 per cent. being allowed to the debtor for the present payment of £350. I desire to know in what time the sum should have been made without any rebate? *Ans. 4 years.*

IV. When S, P, T, are given, to find R.

s which being extracted by the rules of extraction,
 RULE.—=^r (the time given in the question shewing the
p power) will be equal to R.

EXAMPLES.

10. A debt of £315..12..4. ,2d. is due 4 years hence, but it is agreed to take £250. now, what is the rate per cent. that the rebate is made at?

$$\text{Ans. } \frac{315,6175}{250} = 1,26247; \sqrt{1,26247} = 1,06 = 6 \text{ per cent.}$$

11. The present worth of £344..14..9. 1,22 qrs. payable 7 years hence, is £245. at what rate per cent. is rebate made? *Ans. 5 per cent.*

12. There is a debt of £441..17..3. 1,92 qrs. payable in 4 years time, but is agreed to take £350. present payment, I desire to know what rate per cent. rebate is made at?

Ans. 6 per cent.

T H E

T H E

TUTOR's ASSISTANT.

P A R T I V.

D U O D E C I M A L S:

OR, WHAT IS GENERALLY CALLED

Cross Multiplication, and Squaring of Dimensions
by ARTIFICERS and WORKMEN.

RULE for Multiplying DUODECIMALLY.

1. **U**NDER the Multiplicand write the corresponding denominations of the Multiplier.

2. Multiply each term in the Multiplicand (beginning at the lowest) by the feet in the Multiplier; write each result under its respective term, observing to carry an unit for every 12, from each lower denomination to its next superior.

3. In the same manner multiply the Multiplicand by the primes in the Multiplier, and write the result of each term one place more to the right-hand of those in the Multiplicand.

4. Work in the same manner with the seconds in the Multiplier, setting the result of each term two places to the right-hand of those in the Multiplicand, and so on for thirds, fourths, &c.

EXAMPLES.

EXAMPLES.

		<i>f. in.</i>	<i>f. in.</i>		
1. Multiply 7 . 9 by 3 . 6					
<i>Cross Multiplication.</i>		<i>Practice.</i>		<i>Duodecimals.</i>	<i>Decimals.</i>
$\begin{array}{r} 7 \times 9 \\ 3 \times 6 \\ \hline \end{array}$		$\begin{array}{r} 6\frac{1}{2} \times 9 \\ 3 \times 6 \\ \hline \end{array}$		$\begin{array}{r} 7 \times 9 \\ 3 \times 6 \\ \hline \end{array}$	$\begin{array}{r} 7.75 \\ 3.5 \\ \hline \end{array}$
$21.-.=7 \times 3$		23×3		$23 \times 3 \times 3$	3875
$2.3.-.=9 \times 3$		3×10.6		$3 \times 10.6 \times 6$	2325
$3.6.-.=7 \times 6$					
$-4.6.=9 \times 6$		27×1.6		27×1.6	$27,125$
$27.1.6$					

	<i>f. in.</i>	by	<i>f. in.</i>	<i>Facit</i>	<i>f. in.</i>
2. Multiply	8.5.	by	4. 7.	<i>Facit</i>	38. 6.11.
3. Multiply	9.8.	by	7. 6.	<i>Facit</i>	72. 6.
4. Multiply	8.1.	by	3. 5.	<i>Facit</i>	27. 7. 5.
5. Multiply	7 6.	by	5. 9.	<i>Facit</i>	43. 1. 6.
6. Multiply	4.7.	by	3.10.	<i>Facit</i>	17. 6.10.
7. Multiply	7.5.9"	by	3. 5.3"	<i>Facit</i>	25. 8.6.2.3.
8. Multiply	10.4.5.	by	7. 8.6.	<i>Facit</i>	79.11.0.6.6.
9. Multiply	75.7.	by	9. 8.	<i>Facit</i>	730. 7.8.
10. Multiply	97.8.	by	8. 9.	<i>Facit</i>	854. 7.
11. Multiply	57.9.	by	9. 5.	<i>Facit</i>	543. 9.9.
12. Multiply	75.9.	by	17. 7.	<i>Facit</i>	1331.11.3.
13. Multiply	87.5.	by	35. 8.	<i>Facit</i>	3117.10.4.
14. Multiply	179.3.	by	38.10.	<i>Facit</i>	6960.10.6.
15. Multiply	259.2.	by	48.11.	<i>Facit</i>	12677.6.11.
16. Multiply	257.9.	by	39.11.	<i>Facit</i>	10288.6.3.
17. Multiply	311.4.7.	by	36. 7.5	<i>Facit</i>	11402.2.4.11.11.
18. Multiply	321.7.3.	by	9. 3.6.	<i>Facit</i>	2988.2..10.4.6.

The APPLICATION.

Artificer's work is computed by different measures, *viz.*

1. Glazing and mason's flatwork by the foot.
2. Painting, plaistering, paving, &c. by the yard.
3. Partitioning, flooring, roofing, tiling, &c. by the square of 100 feet.
4. Brickwork, &c. by the rod or 16 feet $\frac{1}{2}$, whose square is $272\frac{1}{4}$.

MEASURING *by the FOOT SQUARE, as GLAZIERS and MASONS Flatwork.*

EXAMPLES.

19. There is a house with 3 tier of windows, 3 in a tier, the height of the first tier 7 feet 10 inches, the second 6 feet 8 inches, and the third 5 feet 4 inches, the breadth of each is 3 feet 11 inches, what will the glazing come to at 14d. per foot?

Duodecimals.

7 . 10 the
6 . 8 heights
5 . 4 added

19 . 10

3 = windows

59 . 6 in a tier.

3 . 11 in breadth.

feet. in. pts.

233..—..6 at 14d. per foot.

2d. $\frac{1}{8}$ 233 = 1s.

38..10 = 2d.

$\frac{1}{2}$ = 6 parts.

2|0)27|1..10 $\frac{1}{2}$

£ 13..11..10 $\frac{1}{2}$ Ans.

178 . 6

54 . 6 . 6

233 . — . 6

20. What is the worth of 8 squares of glass, each measuring 4 feet 10 inches long, and 2 feet 11 inches broad, at 4d. $\frac{1}{8}$ per foot? *Ans. £1..18..9.*

21. There are 8 windows to be glazed, each measures 1 foot 6 inches wide, and 3 feet in height, how much will they come to at 7d. $\frac{3}{4}$ per foot. *Ans. £1..3..3.*

22. What is the price of a marble slab, whose length is 5 feet 7 inches, and the breadth 1 foot 10 inches, at 6s. per foot? *Ans. £3..1..5.*

MEASURING *by the YARD SQUARE, as PAVIORS, PAINTERS, PLAISTERERS, and JOINERS.*

NOTE. *Divide the square feet by 9, and it will give the number of square yards.*

EXAMPLES.

23- A room is to be cieled, whose length is 74 feet 9 inches, and width 11 feet 6 inches, what will it come to at 3s. 10d $\frac{1}{2}$. per yard? *Ans. £18..10..1.*

24. What

24. What will the paving of a court-yard come to, at $4d. \frac{3}{4}$ per yard, the length being 58 feet 6 inches, and breadth 54 feet 9 inches? *Ans.* £7..-..10.

25. A room painted 97 feet 8 inches about, and 9 feet 10 inches high, what does it come to at $2s. 8d. \frac{1}{2}$ per yard? *Ans.* £14..11..1.

26. What is the content of a piece of wainscoting in yards square, that is 8 feet 3 inches long, and 6 feet 6 inches broad, and what will it come to at $6s. 7d. \frac{1}{2}$ per yard? *Ans.* £1..19..5.

27. What will the paving a court-yard come to, at $3s. 2d.$ per yard, if the length be 27 feet 10 inches, and the breadth 14 feet 9 inches? *Ans.* £7..4..5.

28. A person has paved a court-yard 42 feet 9 inches in front, and 68 feet 6 inches in depth, and in this he laid a foot-way the depth of the court, of 5 feet 6 inches in breadth: the foot-way is laid with purbeck stone, at $3s. 6d.$ per yard, and the rest with pebbles, at $3s.$ per yard, what will the whole come to? *Ans.* £49..17..-.

29. What will the plaistering a ceiling, at $10d.$ per yard, come to, supposing the length 21 feet 8 inches, and the breadth 14 feet 10 inches? *Ans.* £1..9..9.

30. What will the wainscoting a room come to, at $6s.$ per square yard, supposing the height of the room (taking in the cornice and moulding) is 12 feet 6 inches, and the compass 83 feet 8 inches, the three window shutters each 7 feet 8 inches, by 3 feet 6 inches; and the door 7 feet by 3 feet 6 inches; the shutters and door being worked on both sides, is reckoned work and half work? *Ans.* £36..12..2 $\frac{1}{2}$.

MEASURING *by the SQUARE of 100 feet, as FLOORING, PARTITIONING, ROOFING, TYLING, &c.*

EXAMPLES.

31. In 173 feet 10 inches in length, and 10 feet 7 inches in height of partitioning, how many squares? *Ans.* 18 squares, 39 feet, 8 inches, 10 p.

32. If a house of 3 stories, besides the ground floor, was to be floored at £6..10..- per square, and the house measured 20 feet 8 inches, by 16 feet 9 inches: there are 7 fire places, whose measures are two of 6 feet, by 4 feet 6 inches each, two of 6 feet, by 5 feet 4 inches each, and two of 5 feet 8 inches, by 4 feet 8 inches, and the seventh of 5 feet 2 inches, by 4 feet, and the well-hole for the stairs

stairs is 10 feet 6 inches, by 8 feet 9 inches, what will the whole come to?

Ans. £53..13..3 $\frac{1}{4}$.

33. If a house measures within the walls 52 feet 8 inches in length, and 30 feet 6 inches in breadth, and the roof be of a true pitch, what will it come to roofing at 10s. 6d. per square?

Ans. £12..12..11 $\frac{3}{4}$.

Note. In tiling, roofing, and slating, it is customary to reckon the flat, and half of any building within the wall, to be the measure of the roof of that building, when the said roof is of a true pitch, i. e. when the rafters are $\frac{3}{4}$ of the breadth of the building; but if the roof is more or less than the true pitch, they measure from one side to the other, with a red or string.

34. What will the tiling of a barn cost, at 25s. 6d. per square, the length being 43 feet 10 inches, and breadth 27 feet 5 inches on the flat, the eave boards projecting 16 inches on each side?

Ans. £24..9..5 $\frac{1}{2}$.

MEASURING by the ROD.

Note. Bricklayers always value their work at the rate of a brick and a half thick; and if the thickness of the wall is more or less, it must be reduced to that thickness by this

RULE. Multiply the area of the wall by the number of half bricks the thickness of the wall is of; the product, divided by 3, gives the area.

EXAMPLES.

35. If the area of a wall be 4085 feet, and the thickness two bricks and a half, how many rods doth it contain?

Ans. 25 rods.

36. If a garden wall be 254 feet round, and 12 feet 7 inches high, and 3 bricks thick, how many rods doth it contain?

Ans. 23 rods, 136 feet.

37. How many square rods are there in a wall 62 $\frac{1}{2}$ feet long, 14 feet 8 inches high, and 2 $\frac{1}{2}$ bricks thick?

Ans. 5 rods, 167 feet.

38. If the side walls of an house be 28 feet 10 inches in length, and the height of the roof from the ground 53 feet 8 inches, and the gable (or triangular part at top) to rise 42 course of bricks, reckoning 4 course to a foot. Now, 20 feet high is 2 $\frac{1}{2}$ bricks thick, 20 feet more, at 2 bricks thick, 15 feet 8 inches more, at 1 $\frac{1}{2}$ brick thick, and the gable at 1 brick thick, what will the whole work come to, at £5..16..- per rod?

Ans. £48..13..5 $\frac{1}{2}$.

Multiplying

Multiplying several figures by several, and the product to be produced in one line only.

RULE. Multiply the units of the multiplicand by the units of the multiplier, setting down the units of the product, and carry the tens; next multiply the tens in the multiplicand by the units of the multiplier, to which add the product of the units of the multiplicand multiplied by the tens in the multiplier, and the tens carried; then multiply the hundreds in the multiplicand by the units of the multiplier, adding the product of the tens in the multiplicand multiplied by the tens in the multiplier, and the units of the multiplicand by the hundreds in the multiplier; and so proceed till you have multiplied the multiplicand all through, by every figure in the multiplier.

EXAMPLES.

$$\begin{array}{r} \text{Multiply -- } 35234 \\ \text{by -- } 52424 \\ \hline 1847107216 \end{array}$$

$$\begin{array}{r} 35234 \\ 52424 \\ \hline 140936 \\ 70468 \\ 140936 \\ 70468 \\ 176170 \\ \hline 1847107216 \end{array}$$

EXPLANATION.

First, $4 \times 4 = 16$, that is, 6 and carry 1. *Secondly*, $3 \times 4 + 4 \times 2$, and 1 that is carried is 21, set down 1 and carry 2. *Thirdly*, $2 \times 4 + 3 \times 2 + 4 \times 4 + 2$ carried = 32; that is, 2 and carry 3. *Fourthly*, $5 \times 4 + 2 \times 2 + 3 \times 4 + 4 \times 2 + 3$ carried = 47; set down 7 and carry 4. *Fifthly*, $3 \times 4 + 5 \times 2 + 2 \times 4 + 3 \times 2 + 4 \times 5 + 4$ carried = 60; set down 0 and carry 6. *Sixthly*, $3 \times 2 + 5 \times 4 + 2 \times 2 + 3 \times 5 + 6$ carried = 51; set down 1 and carry 5. *Seventhly*, $3 \times 4 + 5 \times 2 + 2 \times 5 +$ carried = 37, that is 7 and carry 3. *Eighthly*, $3 \times 2 + 5 \times 5 + 3$ carried = 34; set down 4 and carry 3. *Lastly*, $3 \times 5 + 3$ carried = 18; which being multiplied by the last figure in the multiplier, set the whole down, and the work is finished.

T H E

THE TUTOR'S ASSISTANT.

PART V.

A Collection of QUESTIONS set down promiscuously, for the greater Trial of the foregoing RULES.

1. **W**RITE down two millions, five hundred and two thousand, two hundred and five.
2. What is the value of 14 barrels of soap, at $4d.\frac{1}{2}$ per lb. each barrel containing 254 lb.?
Ans. £66..13..6.
3. If £100. principal gain £5. interest in 12 months, what principal will gain £20. in 8 months?
Ans. £600.
4. What number is that from which, if the square of 14 be deducted, and to the remainder the square of 12 be added, the sum will be 250?
Ans. 302.
5. A and B. trade together; A put in £320. for 5 months, B £460. for 3 months, and they gained £100. what must each man receive?
*Ans. A £53..13..9. $\frac{270}{298}$.
and B £46..6..2. $\frac{26}{298}$.*
6. How many yards of cloth, at 17s. 6d. per yard, can I have for 13 cwt. 2 qrs. of wool, at 14d. per lb.?
Ans. 100 yards, 3 qrs. $\frac{1}{2}$.
7. What number added to the cube of 21, will make the sum equal to 113 times 147?
Ans. 7350.
8. If I buy 1000 ells Flemish of linen for 90l. what may I sell it at per ell in London, to gain £10. by the whole?
Ans. 3s. 4d. per ell.
9. A has 648 yards of cloth, at 14s. per yard, ready money, but in barter will have 16s. B has wine at £42. per tun, ready money, the question is, how much wine must be given for the cloth, and what is the price of a tun of wine in barter?
*Ans. £48. the tun, and
10 tun, 3 bds. 12 gal. of wine must be given for the cloth.*
10. A jeweller sold jewels to the value of £1200. for which he received in part 876 French pistoles, at 16s. 6d. each, what sum remains unpaid?
Ans. £477..6..-

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11. An oilman bought 417 cwt. 1 qr. 15 lb. gross weight of train oil, tare 20 lb. per 112 lb. how many neat gallons were there, allowing $7\frac{1}{2}$ lb. to a gallon? *Ans. 5120 gallons.*

12. I bought threescore pieces of Holland for three times as many pounds, and sold them again for four times as much: but if they had cost me as much as I sold them for, what should I have sold them for to gain after the same rate? *Ans. £320.*

13. What number taken from the square of 54 will leave 19 times 46? *Ans. 2042.*

14. If I buy a yard of cloth for 14s. 6d. and sell it for 15s. 9d. what do I gain per cent.? *Ans. £15..10..4.²⁴/₁₇₄.*

15. Bought 27 bags of ginger, each weighing gross 84 lb. $\frac{3}{4}$, tare 1 lb. $\frac{3}{8}$ per bag, trett 4 lb. per 104 lb. what do they come to at 8d. $\frac{1}{2}$ per lb.? *Ans. £76..13..3 $\frac{1}{2}$.*

16. If $\frac{2}{3}$ of an ounce cost $\frac{7}{8}$ of a shilling, what will $\frac{5}{6}$ of a lb. cost? *Ans. 17s. 6d.*

17. If $\frac{5}{6}$ of a gallon cost $\frac{5}{8}$ of a £. what will $\frac{5}{9}$ of a tun cost? *Ans. £105.*

18. A young man received £210. which was $\frac{2}{3}$ of his eldest brother's portion; now three times the eldest brother's portion was half of the father's estate, I demand how much the estate was? *Ans. £1890.*

19. If the salary of an officer be £48. per annum, what must he receive for 232 days? *Ans. £30..10..2 $\frac{1}{4}$.*

20. A gentleman spends one day with another £1..7..10 $\frac{1}{2}$, and at the year's end layeth up £340. what is his yearly income? *Ans. £848..14..4 $\frac{1}{2}$.*

21. A lady's fortune consisted of a cabinet, worth £200. containing 16 drawers, each having two partitions, each of which contained £37. and two crowns, pray what was her portion? *Ans. £1400.*

22. A has 13 fother of lead to send abroad, each being 19 $\frac{1}{2}$ times 112 lb. B has 39 casks of tin, each 388 lb. how many ounces difference is there in the weight of these commodities? *Ans. 212160 oz.*

23. A captain and 160 sailors took a prize worth £1360. of which the captain had $\frac{1}{5}$ for his share, and the rest was equally divided among the sailors, what was each man's part? *Ans. The captain had £272. and each sailor £6..16..-*

24. What number is that, to which if you add $7\frac{2}{3}$, the whole will be $12\frac{1}{4}$. *Ans. $4\frac{7}{12}$.*

25. An usurer put out £75. for 12 months, and received for principal and interest £81. I demand at what rate per cent. he received interest? *Ans. 8 per cent.*

26. What will £956. amount to in $7\frac{1}{2}$ years, at 5 per cent. simple interest? *Ans. £1314..10.-.*

27. At what rate per cent. will £956. amount to £1314. 10s. in $7\frac{1}{2}$ years, at simple interest? *Ans. 5 per cent.*

28. If for £1..4.-. I have 1200lb. weight carried 35 miles, how many lb. weight can I have carried 24 miles for the same money? *Ans. 1800lb.*

29. If 8 cannons in one day spend 48 barrels of powder, I demand how many barrels 24 cannons will spend in 22 days? *Ans. 3168.*

30. What number is that, which being multiplied by $\frac{2}{3}$, will produce $\frac{1}{4}$? *Ans. $\frac{3}{8}$.*

31. A has 24 cows worth 72s. each, and B seven horses worth £13. a piece, how much will make good the difference, in case they interchange their said drove of cattle? *Ans. £4..12.-.*

32. A man dies and leaves £120. to be given to three persons: viz. A, B, and C; to A a share unknown; B twice as much as A, and C as much as A and B; what was the share of each? *Ans. A £20. B £40. and C £60.*

33. A person dying, left his widow £1780. and £1250. to each of his four children; he had been $25\frac{1}{2}$ years in trade, and had cleared (at an average) £126. a year, what had he to begin with? *Ans. £3567.*

34. There is a sum of 1000l. to be divided among 3 men, in such manner, that if A has £3. B shall have 5l. and C. £8. how much must each man have? *Ans. A £187..10.-. B £312..10.-. and C £500.-.*

35. A piece of wainscot is 8 feet 6 inches and $\frac{1}{2}$ long, and 2 feet 9 inches $\frac{3}{4}$ broad, what is the superficial content? *Ans. 24 feet 0..3" ..4..6.*

36. How many changes may be rung on 6 bells? *Ans. 720.*

37. A merchant at Amsterdam is indebted to another in London £642. and would pay it in Spanish guilders, at 2s. per piece, how many must the English merchant receive? *Ans. 6420.*

38. If 360 men be in garrison, and have provision for 6 months, but hearing of no relief at the end of five months, how many men must depart, that the provisions may last so much the longer? *Ans. 288 men.*

39. The less of two numbers is 187, their difference 34, the square of the product is required? *Ans. 1707920929.*

40. A butcher sends his man with £216. to a fair to buy cattle; oxen at £11. cows at 40s. colts at £1..5.-. and hogs

hogs at £1..15... per piece, and of each a like number, how many of each sort did he buy?

Ans. 13 of each sort, and 8 over.

41. What number added to $11\frac{2}{3}$, will produce $36\frac{37}{8}$?

Ans. $24\frac{51}{16}$.

42. What number multiplied by $\frac{3}{4}$ will produce $11\frac{2}{7}$?

Ans. $26\frac{4}{5}$.

43. A man had 12 sons; the youngest was three years old, and the eldest 58; they increased in arithmetical progression, what was the common difference of their ages?

Ans. 5 years.

44. What is the value of 179 hogheads of tobacco, each weighing 13 cwt. at £2..7..1. per cwt.? *Ans.* £5478..2..11.

45. My factor sends me word he has bought goods to the value of £500..13..6. upon my account, what will his commission come to at $3\frac{1}{2}$ per cent.? *Ans.* £17..10..5. 2qrs. $\frac{68}{100}$.

46. Miss Kitty told her sister Charlotte, whose father had before left them £13200. a-piece, that their grandmother by will had raised her fortune to £15000. and had made her own £20000. what did the old lady leave them? *Ans.* £8600.

47. A snail in getting up a may-pole only 20 feet high, was observed to climb 8 feet every day, but every night he came down again 4 feet; in what time by this method did he reach the top of the pole?

Ans. 4 days.

48. If the $\frac{1}{3}$ of 6 be 3, what will $\frac{1}{4}$ of 20 be? *Ans.* $7\frac{1}{2}$.

49. What is the difference between 14676, and the fourth of itself?

Ans. 11007.

50. There is in three bags the sum of £1468. viz. in the first bag £461. in the second £581. what was in the third bag?

Ans. £426.

51. What is the decimal of 3qrs. 14lb. of an cwt. *Ans.* .875.

52. How many lb. of sugar, at $4d.\frac{1}{2}$ per lb. must be given in barter for 60 gross of incle, at 8s. 8d. per gross?

Ans. $1386\frac{2}{3}$.

53. If I buy yarn for 9d. the lb. and sell it gain for $13d.\frac{1}{2}$ per lb. what is the gain per cent.?

Ans. £50.

54. A tobacconist would mix 20lb. of tobacco, at 9d. per lb. with 60lb. at 12d. per lb. 40lb. at 18d. per lb. and with 12 lb. at 2s. per lb. what is a lb. of this mixture worth?

Ans. 1s. $2d.\frac{1}{4}\frac{1}{11}$.

55. What is the value of 14 barrels of soap, at $4d.\frac{1}{2}$ per lb. each barrel containing 254 lb.?

Ans. £66..13..6.

56. Two persons, A and B, owe several debts; the lesser debt being that of A is £2175. the difference is £371. what is the debt of B?

Ans. £2544.

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57. What is the difference between twice eight and twenty and twice twenty-eight: as also between twice five and fifty and twice fifty-five? *Ans. 20 and 50.*

58. What number taken from the square of 54 will leave 19 times 46? *Ans. 2042.*

59. A schoolmaster being asked how many scholars he had, said, If I had as many more, half as many, and 1 quarter as many, I should have 99, how many had he? *Ans. 36.*

60. An ancient lady being asked how old she was, to avoid a direct answer, said, I have 9 children, and there are 3 years between the birth of each of them; the eldest was born when I was 19 years old, which is now exactly the age of the youngest; how old was the lady? *Ans. 62.*

61. What number is that which being added to 168 make the sum to be 706? *Ans. 538.*

62. From £100. borrowed, take 72 paid;

'T was a virgin that lent it, what's due to the maid?

Ans. £28.

63. If when wheat is 4s. the bushel, the 20 penny loaf weighs 18lb. what must the said 20 penny loaf weigh, when wheat is 6s. the bushel? *Ans. 12lb.*

64. Whereas a noble and a mark just 15 yards did buy;

How many ells of the same cloth for £50. had I? *Ans. 600.*

65. A broker bought for his principal in the year 1720, £400. capital stock in the South Sea, at £650. per cent. and sold it again when it was worth but £130. per cent. how much was lost in the whole? *Ans. £2080.*

66. What number added to the 43d part of 4429, will make the sum 240? *Ans. 137.*

67. What number deducted from the 26th part of 2262 will leave the 87th part of the same? *Ans. 61.*

68. A gentleman went to sea at 17 years of age; 8 years after that he had a son born, who lived 46 years, and died before his father; after whom the father lived twice 20 years, and then died also; what was the age of the father when he died? *Ans. 111.*

69. C hath candles at 6s. per dozen ready money, but in barter will have 6s. 6d. per dozen; D hath cotton at 9d. per lb. ready money; I demand what price the cotton must be at in barter; also how much cotton must be bartered for 100 dozen of candles? *Ans. The cotton at 9d. 3qrs. per lb. and 7 cwt. 0 qrs. 16 lb. of cotton must be given for 100 doz. of candles.*

70. The sum of two numbers is 360, the less 114, what is their difference, product, and larger quote?

Ans. 132 diff. 28044 prod. 715.

71. A brigade of horse, consisting of 384 men, is to be formed into a square body, having 32 men in front, how many ranks will there be?

Ans. 12.

72. If a clerk's salary be £73. a-year, what is that per day?

Ans. 4s.

73. B hath an estate of £53. per annum, and payeth 5s. 10d. to the subsidy, what must C pay, whose estate is worth £100. per annum?

Ans. 11s. 0d. $\frac{4}{3}$.

74. If I buy 100 yards of ribband at 3 yards for a shilling, and 100 more at 2 yards for a shilling, and sell it at the rate of 5 yards for 2 shillings, whether do I get or lose, and how much?

Ans. lose 3s. 4d.

75. What is the value of $\frac{3}{8}$ of 20s.?

Ans. 12s. 6d.

76. What number is that, from which if you take $\frac{3}{5}$, the remainder will be $\frac{1}{8}$?

Ans. $\frac{29}{40}$.

77. My purse and money quoth Dick, are worth 12s. 8d. but the money is worth $\frac{7}{10}$ of the purse, pray what is the sum therein?

Ans. 11s. 1d.

78. What number is that which maketh 9 to be the $\frac{2}{3}$ of it?

Ans. $13\frac{1}{2}$.

79. A maltster has several sorts of malt, one at 4s. 6d. another at 4s. and a third at 3s. 6d. a bushel; to mix an equal quantity of each, what must be the price of a bushel?

Ans. 4s.

80. A farmer is willing to make a mixture of rye at 4s. a bushel, barley at 3s. and oats at 2s. how much must he take of each to sell it at 2s. 6d. the bushel?

Ans. 6 of rye, 6 of barley, and 24 of oats.

81. If $\frac{3}{5}$ of a ship be worth £3740. what is the worth of the whole?

Ans. £9973..6..8.

82. A person said he had 20 children, and that it happened there was a year and a half between each of their ages; his eldest son was born when he was 24 years old, and the age of his youngest is 21, what was the father's age?

Ans. 73 $\frac{1}{2}$ years.

83. Bought a cask of wine for £62..8..-. how many gallons were in the same, when a gallon was valued at 5s. 4d.?

Ans. 234.

84. B owes C £296..17..-. but he compounds for 7s. 6d. in the pound, what must C receive for his debt?

Ans. £111..6..4 $\frac{1}{2}$.

85. How many dozen of stockings, at 11 groats per pair, may I buy for £190..12..-?

Ans. 86 doz. 7 pair $\frac{3}{4}$.

86. A sheepfold was robbed 3 nights successively; the first night half the sheep were stolen, and half a sheep more;

the second night half the remainder were lost, and half a sheep more; the last night they took half that were left, and half a sheep more; by which time they were reduced to 20; how many were they at first? *Ans.* 167.

87. The Spectator's club of fat people, though it consisted but of 15 persons, is said to weigh no less than 3 tons, how much at an equality was that per man? *Ans.* 4 cwt.

88. A merry young fellow in a small time got the better of $\frac{1}{3}$ of his fortune; by advice of his friends, he gave £2200. for an Exempt's place in the Guards; his profusion continued till he had no more than 880 guineas left, which he found by computation was $\frac{3}{20}$ part of his money after the commission was bought; pray what was his fortune at first?

Ans. £10450.

89. Bowes C £395..18..-. but compounds the whole debt for £100..12..-. what is that in the pound?

Ans. 5s. 0d. $\frac{3}{4}$ $\frac{7446}{1918}$.

90. How many dollars, at 4s. 4d. each, must be given for 360 guilders, at 2s. 2d. each? *Ans.* 180.

91. Four men have a sum of money to be divided amongst them in such a manner, that the first shall have $\frac{1}{3}$ of it, the second $\frac{1}{4}$, the third $\frac{1}{6}$, and the fourth the remainder, which is 28, what is the sum? *Ans.* 112.

92. What is the amount of £1000. for 5 years $\frac{1}{2}$. at $4\frac{1}{2}$ per cent. simple interest? *Ans.* £261..5..-.

93. Sold goods amounting to the value of £700. for two 4 months, what is the present worth, at 5 per cent. simple interest? *Ans.* £682. 10s.

94. A room 30 feet long, and 18 feet wide, is to be covered with painted cloth, how many yards of $\frac{1}{4}$ wide will cover it? *Ans.* 80 yards.

95. There are two numbers, the one 48, the other twice as much, what is the difference between their sum and difference? *Ans.* £96.

96. Hetty told her brother George, that though her fortune on her marriage took £19312 out of her family, it was but $\frac{2}{3}$ of two years rent; Heaven be praised! of his yearly income, pray what was that? *Ans.* £16093..6..8. a year.

97. There are two numbers, the one 25, the other the square of 25, I demand the square root of the sum of their squares? *Ans.* 625, 4998.

98. Says B to C, if I had four of your sheep, I should have as many as you; and says C to B, if I had four of yours, I should have twice as many as you; how many had each?

Ans. B 20, C 28.

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99. B; C, and D trading together gained £120. which is to be shared according to each man's stock; B put in £140., C £300; and D £160. what is each man's share?

Ans. B £28. C. £60. D £32.

100. A gentleman having 50s. to pay amongst his labourers for a day's work, would give to every boy 6d. to every woman 8d. and to every man 16d. the number of boys, women, and men, was the same, I demand the number of each?

Ans. 20 of each.

101. There are 3 numbers, 17, 19, and 48, I demand the difference between the sum of the squares of the first and last, and the cube of the middlemost?

Ans. 4266.

102. A stone that measures 4 feet 6 inches long, 2 feet 9 inches broad, and 3 feet 4 inches deep, how many solid feet doth it contain?

Ans. 41 feet 3 inches.

103. What does the whole pay of a man of war's crew of 640 sailors amount to for 32 months service, each man's pay being 22s. 6d. per month?

Ans. £23040.

104. If I have an estate of £470. per annum, what may I expend daily, and yet lay up £130. per annum?

Ans. 18s. 7d. $\frac{1}{2}$ $\frac{20}{363}$.

105. What number is that, which being divided by 19, the quotient will be 72?

Ans. 1368.

106. Reduce $13\frac{1}{2}$ bushels of coals to the fraction of a chaldron.

Facit $\frac{3}{8}$.

107. Bought 28 qrs. 2 bushels of wheat, at 4s. 6d. per bushel, what does it come to?

Ans. £50..17..-

108. How many pounds of coffee, at 5s. 9d. per lb. is equal in value to 426lb. of tea, at 13s. 4d. per lb.?

Ans. £987 $\frac{37}{80}$.

109. What is the value of 27 dozen, 10lb. of candles, at 5d. per lb.?

Ans. £6..19..2.

110. A traveller would change 500 French crowns, at 4s. 6d. per crown, into sterling money, but he must pay a half-penny per crown for change, how much must he receive?

Ans. £111..9..2.

111. There are two numbers, the one 63, and the other $\frac{1}{2}$ as much, I demand the product of their squares, and the difference of their product and sum?

Ans. Product of their squares 3938240, 25. difference 1890.

112. B and C traded together, and gained £100; B put in £640.; C put in so much, that he might receive £60. of the gain, I demand how much C put in?

Ans. £960.

113. Of what principal sum did £20. interest arise in one year, at the rate of 5 per cent. per annum? *Ans.* £400.

114. Having bought 40 yards of cloth, at 8s. per yard, and 70 yards at 12s. what is the value of both pieces?

Ans. £58.

115. Two men depart both from one place, the one goes North, the other South; the one goes 7 miles, and the other 11 miles a day, how far are they distant at the 12th day of their departure?

Ans. 216 miles.

116. In 672 Spanish guilders of 2s. each, how many French pistoles, at 17s. 6d. per piece?

Ans. 76 $\frac{2}{3}$.

117. In 7 cheefes, each weighing 1 cwt. 2 qrs. 5lb. how many allowances for seamen may be cut, each weighing 5 oz. 7 drams?

Ans. 3563 $\frac{1}{4}$.

118. If 48 taken from 120 leaves 72, and 72 taken from 91 leaves 19, and 7 taken from thence leaves 12, what number is that, out of which, when you have taken 48, 72, 19, and 7, leaves 12?

Ans. 158.

119. A farmer ignorant of numbers, ordered £500. to be divided among his 5 sons, thus: give A, says he, $\frac{1}{3}$, B $\frac{1}{4}$, C $\frac{1}{5}$, D $\frac{1}{6}$, E $\frac{1}{7}$ part; divide this equitably among them, according to the father's intention.

Ans. A 152 $\frac{1392}{1734}$, B 114 $\frac{1014}{1734}$, C 91 $\frac{1156}{1734}$.

D 76 $\frac{696}{1734}$, E 65 $\frac{296}{1734}$.

120. When first the marriage-knot was ty'd,,

Between my wife and me,

Her age did mine as far exceed,

As three times three does three;

But when seven years, and half seven years,

We man and wife had been,

My age came then as near to her's,

As eight is to sixteen.

Quest. What was each of our ages when we married?

Ans. 10 $\frac{1}{2}$ years the man, 31 $\frac{1}{2}$ the woman.

121. If 12 oxen will eat 3 $\frac{1}{2}$ acres of grass in four weeks, and 21 oxen will eat 10 acres in 9 weeks, how many oxen will eat 24 acres in 18 weeks, the grass being allowed to grow uniformly.

Ans. 36.

122. A lady was asked her age, who replied thus:

My age if multiplied by three,

Two-sevenths of that product tripled be,

The square root of two-ninths of that is four;

Now tell my age, or never see me more.

Ans. 21 years.

A TABLE for finding the INTEREST of any sum of money for any number of months, weeks, or days, at any rate per cent.

Year.	Calen. Mon.	Weeks.	Day.
£ ^s	£. s. d.	£. s. d.	£. s. d.
1	... 1..8	... 4 $\frac{1}{2}$	... 1 $\frac{1}{2}$
2	... 3..4	... 9	... 1 $\frac{1}{2}$
3	... 5..	... 1.. 1 $\frac{1}{2}$	... 2
4	... 6..8	... 1.. 6 $\frac{1}{2}$	... 2 $\frac{1}{2}$
5	... 8..4	... 1.. 11	... 3 $\frac{1}{2}$
6	... 10..	... 2.. 3 $\frac{1}{2}$	... 4
7	... 11..8	... 2.. 8 $\frac{1}{2}$	... 4 $\frac{1}{2}$
8	... 13..4	... 3.. 1	... 5 $\frac{1}{2}$
9	... 15..	... 3.. 5 $\frac{1}{2}$	... 6
10	... 16..8	... 3.. 10 $\frac{1}{2}$	... 6 $\frac{1}{2}$
20	... 1.. 13..4	... 7.. 8 $\frac{1}{2}$	... 1.. 1 $\frac{1}{2}$
30	... 2.. 10..	... 11.. 6 $\frac{1}{2}$	... 1.. 7 $\frac{1}{2}$
40	... 3.. 6..8	... 15.. 4 $\frac{1}{2}$	... 2.. 2 $\frac{1}{2}$
50	... 4.. 3..4	... 19.. 2 $\frac{1}{2}$	... 2.. 9
60	... 5..	... 1.. 3.. 1	... 3.. 3 $\frac{1}{2}$
70	... 5.. 16..8	... 1.. 6.. 11	... 3.. 10
80	... 6.. 13..4	... 1.. 10.. 9 $\frac{1}{2}$	... 4.. 4 $\frac{1}{2}$
90	... 7.. 10..	... 1.. 14.. 7 $\frac{1}{2}$	... 4.. 11 $\frac{1}{2}$
100	... 8.. 6..8	... 1.. 18.. 5 $\frac{1}{2}$	... 5.. 5 $\frac{1}{2}$
200	... 16.. 13..4	... 3.. 16.. 11	... 10.. 11 $\frac{1}{2}$
300	... 25..	... 5.. 15.. 4 $\frac{1}{2}$	... 16.. 5 $\frac{1}{2}$
400	... 33.. 6..8	... 7.. 13.. 10	1.. 1.. 11
500	... 41.. 13..4	... 9.. 12.. 3 $\frac{1}{2}$	1.. 7.. 4 $\frac{1}{2}$
600	... 50..	... 11.. 10.. 9	1.. 12.. 10 $\frac{1}{2}$
700	... 58.. 6..8	... 13.. 9.. 2 $\frac{1}{2}$	1.. 18.. 4 $\frac{1}{2}$
800	... 66.. 13..4	... 15.. 7.. 8 $\frac{1}{2}$	2.. 3.. 10
900	... 75..	... 17.. 6.. 1 $\frac{1}{2}$	2.. 9.. 3 $\frac{1}{2}$
1000	... 83.. 6..8	... 19.. 4.. 7 $\frac{1}{2}$	2.. 14.. 9 $\frac{1}{2}$
2000	... 166.. 13..4	... 38.. 9.. 2 $\frac{1}{2}$	5.. 9.. 7
3000	... 250..	... 57.. 13.. 10	8.. 4.. 4 $\frac{1}{2}$
4000	... 333.. 6..8	... 76.. 18.. 5 $\frac{1}{2}$	10.. 19.. 2
5000	... 416.. 13..4	... 96.. 3..	13.. 13.. 11 $\frac{1}{2}$
6000	... 500..	... 115.. 7.. 8 $\frac{1}{2}$	16.. 8.. 9
7000	... 583.. 6..8	... 134.. 12.. 3 $\frac{1}{2}$	19.. 3.. 6 $\frac{1}{2}$
8000	... 666.. 13..4	... 153.. 16.. 11	21.. 18.. 4 $\frac{1}{2}$
9000	... 750..	... 173.. 1.. 6 $\frac{1}{2}$	24.. 13.. 1 $\frac{1}{2}$
10,000	... 833.. 6..8	... 192.. 6.. 1 $\frac{1}{2}$	27.. 7.. 11 $\frac{1}{2}$
20,000	... 1666.. 13..4	... 384.. 12.. 3 $\frac{1}{2}$	54.. 15.. 10 $\frac{1}{2}$
30,000	... 2500..	... 576.. 18.. 5 $\frac{1}{2}$	82.. 3.. 10

RULE. Multiply the principal by the rate per cent. and the number of months, weeks, or days, which are required, cut off two figures on the right-hand side of the product, and collect from the table the several sums against the different numbers as when added will make the number remaining. Add the several sums together it will give the interest required.

N. B. For every 10 that is cut off in months, add 2d.; for every 10 cut off in weeks, add an halfpenny; and for every 40 in the days, 1 farthing.

EXAMPLES.

1. What is the interest of £2467..10..- for 10 months at 4 per cent. per annum?

$$\begin{array}{r} 2467 \dots 10 \\ \quad \quad 4 \\ \hline 9870 \dots - \\ \quad 10 \end{array}$$

$$\begin{array}{r} 900 = 75 \dots 15 \\ 80 = 6 \dots 13 \dots 4 \\ 7 = \dots 11 \dots 8 \\ \hline 987 = 82 \dots 5 \dots \end{array}$$

987100

2. What is the interest of £2467..10..- for 12 weeks, at 5 per cent.?

$$\begin{array}{r} 2467..10 \\ 5 \\ \hline 12337..10 \\ 12 \end{array}$$

$$\begin{array}{rcl} 1000 & = & 19.. 4.. 7\frac{1}{4} \\ 400 & = & 7.. 13.. 10 \\ 80 & = & 1.. 10.. 9\frac{1}{4} \\ 50 & = & \text{---}.. 2\frac{1}{2} \end{array}$$

$$1480 \div 50 = 28 \dots 9.5$$

1480|50.—

3. What is the interest of £2467..10..- for 50 days, at 6 per cent. ?

$$\begin{array}{r} 2467.10 \\ 6 \\ \hline 14805.00 \\ 50 \end{array}$$

$$\begin{array}{r} 7000 = 19..3.. 6\frac{1}{2} \\ 400 = 1..1..11 \\ 2 = \text{---}.. \text{---}.. 1\frac{1}{4} \\ 50 = \text{---}.. \text{---}.. \frac{1}{4} \\ \hline 7402 | 50 = 20..5.. 7 \end{array}$$

$$7402 \mid 50 = 20..5.. 7$$

7402150

To find what any estate, from 1 to £60,000. per annum, will come to for 1 day.

RULE. Collect the annual rent or income from the table for one year, against which take the several sums for one day, add them together, it will give the answer.

An estate of £376. per annum, what is that per day?

$$\begin{array}{r} 300 = -..16.. \quad 5\frac{1}{2} \\ 70 = -.. \quad 3..10 \\ 6 = -..-.. \quad 4 \end{array}$$

$$376 \equiv 1 \dots - \dots 7\frac{1}{2}$$

To find the amount of any income, salary or servant's wages, for any number of months, weeks, or days.

RULE. Multiply the yearly income or salary by the number of months, weeks, or days, and collect the product from the table.

What

What will £270. per annum come to for 11 months, for 3 weeks, and for 6 days?

For 11 Months.

$$\begin{array}{r} 270 \quad 2000 = 166..13..4 \\ 11 \quad 900 = 175..1..- \\ \hline 70 = 5..16..8 \\ 2970 \quad \hline 2970 = 246..10..- \end{array}$$

For 6 Days.

$$\begin{array}{r} 279 \quad 1000 = 2..14..9\frac{1}{2} \\ 6 \quad 600 = 1..12..10\frac{1}{2} \\ \hline 20 = -..1..1 \\ 1620 \quad \hline 1620 = 4..8..9 \end{array}$$

For 3 Weeks.

$$\begin{array}{r} 270 \quad 800 = 15..7..8\frac{1}{4} \\ 3 \quad 10 = -..3..10 \\ \hline 810 \quad \hline 810 = 15..11..6\frac{1}{4} \end{array}$$

For the whole Time.

$$\begin{array}{r} 247..10..- \\ 15..11..6\frac{1}{4} \\ \hline 4..8..9 \end{array}$$

$$257..10..3\frac{1}{4}$$

A TABLE, shewing the number of days from any day in the month to the same day in any other month, through the year.

	To	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug	Sept	Oct.	Nov	Dec.
From	Jan.	365	31	59	90	120	151	181	212	243	273	304	334
	Feb.	334	365	28	59	89	120	150	181	212	242	273	303
	Mar.	306	337	365	31	61	92	122	153	184	214	245	275
	Apr.	275	306	334	365	30	61	91	122	153	183	214	244
	May	245	276	304	335	365	31	61	92	123	153	184	218
	June	214	245	273	304	334	365	30	61	91	122	153	183
	July.	184	215	243	274	304	335	365	31	62	92	123	153
	Aug.	153	184	212	243	273	304	334	365	31	61	92	122
	Sept	122	153	181	212	242	273	303	334	365	30	61	91
	Oct.	92	123	151	182	212	243	273	304	335	365	31	61
	Nov	61	92	120	151	181	212	242	273	304	334	365	30
	Dec.	31	62	90	121	151	182	212	242	274	304	335	365

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For 11 Months.

$$\begin{array}{r} 270 \quad 2000 = 166..13..4 \\ 11 \quad 900 = 75..-..- \\ \hline 70 = 5..16..8 \\ 2970 \end{array}$$

$$2970 = 246..10..-$$

For 6 Days.

$$\begin{array}{r} 279 \quad 1000 = 2..14..9\frac{1}{2} \\ 6 \quad 600 = 1..12..10\frac{1}{2} \\ \hline 20 = -..1..1 \\ 1620 \end{array}$$

$$1620 = 4..8..9$$

For 3 Weeks.

$$\begin{array}{r} 270 \quad 800 = 15..7..8\frac{1}{4} \\ 3 \quad 10 = -..3..10 \\ \hline 810 = 15..11..6\frac{1}{4} \end{array}$$

For the whole Time.

$$\begin{array}{r} 247..10..- \\ 15..11..6\frac{1}{4} \\ \hline 4..8..9 \end{array}$$

$$257..10..3\frac{1}{4}$$

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	Oct.	92	123	151	182	212	243	273	304	335	365	31	61
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